



Sturtevant

REG. U.S. PAT. OFF.

UNIT VENTILATORS

SUPPLY FRESH OUTDOOR AIR — FILTERED CLEAN — AND TEMPERED

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Unit Ventilators

Supply fresh outdoor air — filtered and tempered



Catalog No. 377

B. F. STURTEVANT COMPANY

Plants and Offices at: Berkeley, Cal. ↘ Camden, N. J. ↘ Framingham, Mass.
Galt, Ontario ↘ Hyde Park, Mass. ↘ Sturtevant, Wis.

See page 46 for list of local branches



The New Sturtevant Unit Ventilator

THOUSANDS of Sturtevant Unit Ventilators are giving eminently satisfactory service, both in this country and abroad.

Intended originally for schools, this product has widened its field with startling rapidity until today it has become a common means for ventilating all types of public and private buildings, some of which have particularly severe requirements along certain lines. These conditions have made flexibility and adaptability imperative and have led to the development of a Sturtevant Unit Ventilator with new and exclusive features and improvements both in performance and design.

A new standard of quietness.

Partial recirculation for greater economy in operation.

Self-contained automatic temperature control.

Reduced size with equal capacity.

New arrangements for wider application.

All of these achievements are outlined in the ensuing pages together with suggestions for new and important applications. We invite your inspection and due consideration.

What Is Ventilation?

VENTILATION is a science, and its purpose is to promote human health, comfort, and efficiency by means of proper air conditions. Therefore, the test of ventilation is the measure of health, comfort, and efficiency derived from it. Today we spend by far the greater part of our time indoors, and the space allowable per person is constantly decreasing under the pressure of modern affairs. Ventilation, therefore, is now a vital requirement of life, and the modern building must be ventilated properly if the people using it are to be comfortable, efficient, and healthy.

Scientific ventilation accomplishes certain definite results with respect to the condition of the air. Hence, the first requirement of a ventilating system is Air Volume. All other requirements depend directly upon the quantity of air introduced into any given space, not so much for the needs of the lungs, but to provide the media by which body heat and odors are carried away and bodily comfort is maintained. The quantity of air handled is the basis of the design of a ventilating system.

Proper Air Temperature, produced by either warming or cooling, is the second requirement and is dependent upon Air Motion and Air Distribution for satisfactory control. Air distribution in connection with air motion plays its part in providing tempered air and bodily comfort throughout an occupied space so that all in that space may benefit.

Relative Humidity, or the amount of moisture present in the air, must be controlled wherever conditions are such that the relative humidity is very high or very low. Its importance as a factor to be controlled by the ventilating system depends upon local conditions.

Good ventilation produces a pleasant

Psychological Effect. The general public is gradually becoming educated to the value of good ventilation, and they like to know that ventilation is provided for their comfort.

Lastly, but one of the most important points, is Air Purity. This means freedom from odors, dust, bacteria, toxic gases, and other objectionable matter. These, of course, must be eliminated from the air we breathe, if health is to be maintained.

Wherever people gather we know that body odor and also other kinds of odors are present. One of the biggest problems of a ventilating system, in addition to furnishing air for breathing, is to supply a sufficient quantity of air to dissipate and dilute these objectionable odors. This the Sturtevant Unit Ventilator does because it is constantly admitting a definite quantity of fresh filtered air, with the result that the foul, vitiated air is removed.

Volume, temperature, humidity, motion, and distribution can all be mathematically expressed and are, therefore, the basis for exact determination. A complete system of ventilation can be designed to fulfill any given set of conditions in these respects. There are many methods of accomplishing these ends, and it is the function of the manufacturer to provide, at reasonable cost, necessary mechanical equipment from the standpoints of performance, suitability, and flexibility.

The apparatus described in this book is offered to the public on this basis. It has been tried and proven. It has been carefully developed through years of constant research and experiment.

In common with all equipment bearing the Sturtevant name plate, it will do the job for which it is intended.

What Is a Sturtevant Unit Ventilator?

IT is a product of engineering skill designed for the purpose of providing good ventilation on the basis of the following requirements:

Air Volume	Air Motion
Air Temperature	Air Purity
Relative Humidity	Air Distribution
Psychological Effects	

Intended originally for schools, the Sturtevant Unit Ventilator has widened its field with startling rapidity, until today it has become a common means for ventilating all types of public and private buildings, some of which have particularly severe requirements along certain lines. These conditions have made flexibility and adaptability imperative. The Sturtevant Unit Ventilator is so designed that it can be made to function in harmony with any of several objectives desired by the operator, or as intended by the architect, engineer, or owner.

This is a unique achievement and one in which Sturtevant takes justifiable pride. It is not to be confused with any so-called system of ventilation. The professional engineer or architect rightfully has the prerogative to select mechanical equipment to suit the individual requirements. The examples given in the following pages indicate how truly flexible the Sturtevant Unit Ventilator is in providing desired results. Before going further it is well to examine the Sturtevant Unit as to its construction.

The parts are housed in a furniture steel cabinet, small in size and delightfully pleasing in appearance. Olive green is the standard color, but the finish can be made to match any interior treatment on special order, and the selection of colors is unlimited. The Sturtevant Unit Ventilator is placed against an exterior wall, and

usually beneath a window. Because of its exceptionally low height, it is possible to place it in the most central location without interference with the window-sills. Its quiet-operating motor-driven fans draw air from the out-of-doors, recirculate room air, or handle both recirculated and out-of-door air in desired proportions. The air is filtered clean of dust and dirt, warmed to the proper temperature during cold weather, to provide comfort in the room, and discharged vertically through the top of the cabinet in a manner which insures thorough distribution and a pleasing motion of pure air.

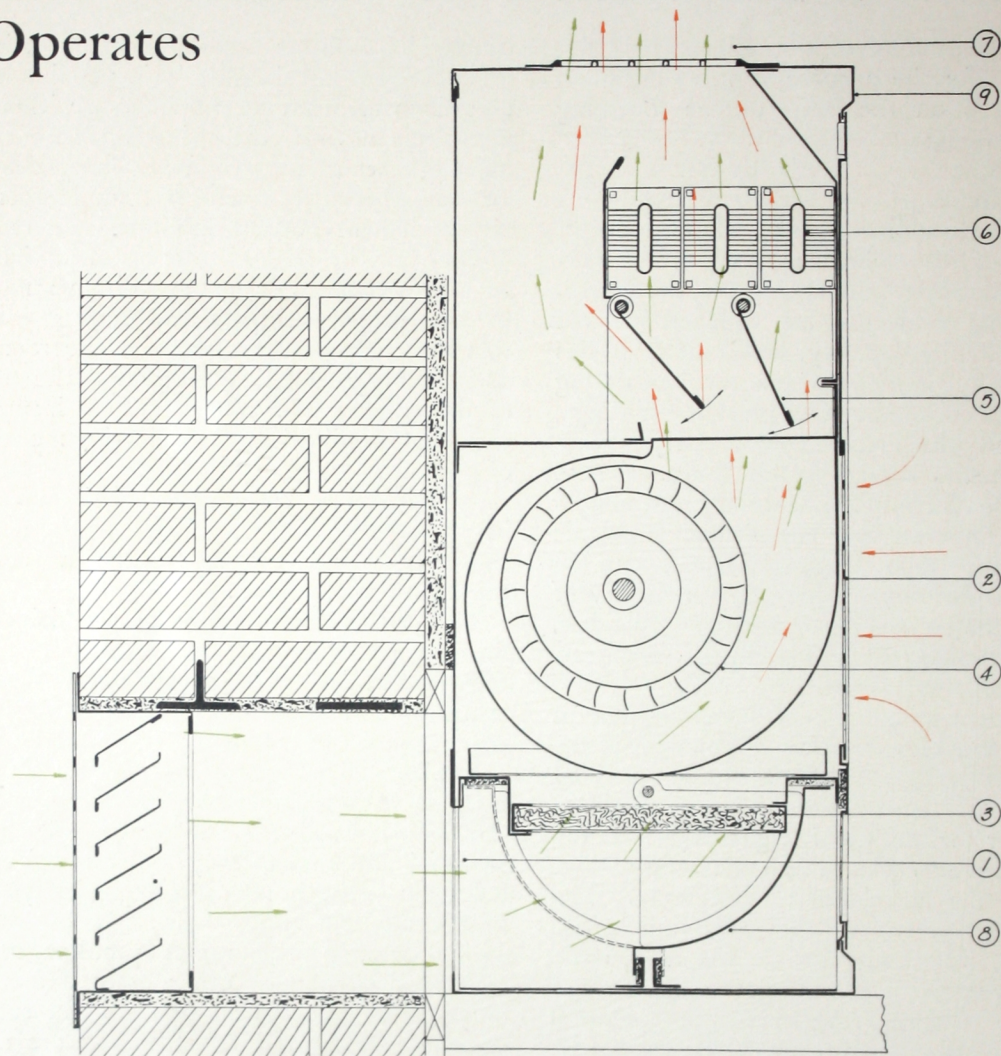
An automatic temperature regulator can be provided within the cabinet, or the unit can be arranged for control by a room thermostat or by hand.

Two of the above features are exclusively Sturtevant!

Partial recirculation as applied to Unit Ventilators is a new idea. Demanded for the purpose of reducing investment in plant, as well as operating costs by those familiar with the fact that latest research shows "All Fresh Air," at all times, to be wasteful and unnecessary and all recirculated air to be impossible hygienically, it fills a modern requirement. Local laws and regulations sometimes prohibit any recirculation, and in other cases allow it only during unoccupied periods. In such cases Sturtevant Unit Ventilators are arranged to comply with the regulations.

Self-Contained Automatic Temperature Regulation is also new and is to be obtained only with Sturtevant Unit Ventilators. Proved by many successful installations to be ideal as a thermal control, it is announced as a standard accessory which may be furnished with the unit or applied after installation if desired.

How the Sturtevant Unit Ventilator Operates



1. Fresh air enters unit from out-of-doors.
2. Recirculated air enters from room if partial recirculating feature is provided.
3. Air Filters clean the air.
4. "Multivane" fans driven by a Sturtevant "Super Silent" electric motor move air quietly through unit as shown by arrows.
5. Temperature control dampers enable heat supplied by unit to be balanced with heat required by the room without changing volume of air.

6. Light-weight fin-type heating surface, for either steam or hot water, warms air to proper temperature.
7. Air discharges to room in vertical direction at proper velocity to provide pleasing air motion and thorough diffusion without drafts.
8. Inlet damper closes the opening to out-of-doors when it is desired to recirculate entirely or when fans are not running.
9. Furniture steel cabinet with finish of high quality, houses all parts.

Where Sturtevant Unit Ventilators Should Be Used

THEY should be used wherever people gather indoors — where ventilation, without drafts, is wanted. In schools, club houses, public buildings, hospitals, churches, homes, and offices. Where it is necessary or desirable to ventilate each room independently of the other rooms.

Sturtevant Unit Ventilators are particularly suitable where easy and economical operation is desirable. Operation is as simple as that required by any household electrical appliance. Air temperature can be regulated to any desired degree — either by hand or by automatic control. Rooms used only at intervals may be heated quickly — or left unheated at will.

Unit Ventilators are ideal for ventilating buildings not originally equipped with a system of positive ventilation. They can be installed wherever a supply of low-pressure steam and electric current is available.

If people were satisfied with warmth alone — without pure, fresh air — the unit ventilation principle would never have evolved. Stoves would have sufficed. But the utilization of tempered out-of-door air for heating and ventilating has proved itself in school and office and workshop to have a healthy, invigorating effect.

In schools, for instance, fresh air is a prerequisite, needing no discussion. School children deserve to be as physically comfortable as modern science can make them. Nothing so

keeps growing bodies fit or gives puzzled minds the energy necessary to master the lesson as to be in a classroom comfortably heated and ventilated with fresh, outdoor air of proper and unvarying temperature. Unit Ventilators have been specified for schools in increasingly large numbers during the last few years.

Safe ventilation is an absolute necessity in all buildings. Many attempts have been made to provide safe ventilation without mechanical devices. Invariably they fail in their purpose. The increasing use of mechanical ventilating devices is sufficient proof that they are necessary to adequate, positive, and safe ventilation.

Sturtevant Unit Ventilators may be used in any room or building, either domestic or commercial, where fresh air at any agreeable temperature is needed at any time — regardless of weather conditions. The use of these units in schools and commercial buildings obviates the need of large apparatus rooms, deep basements, and elaborate duct work. The savings thus made are distinct and worth while. In homes and clubs their comfort qualities are typical of modern times.

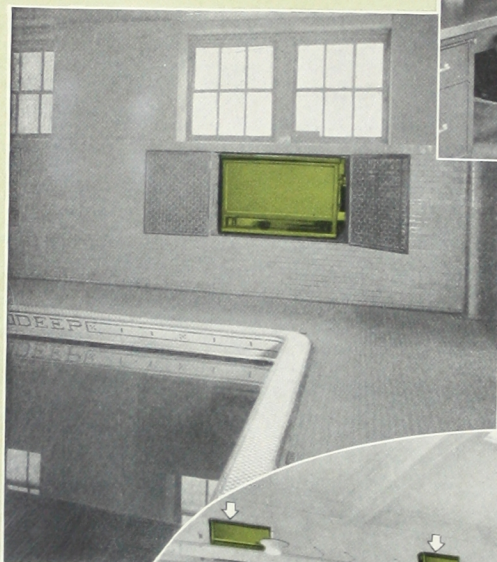
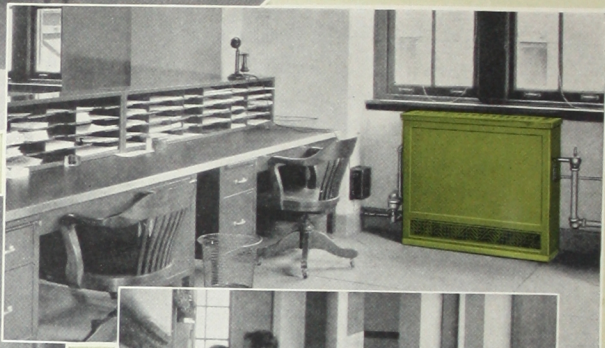


STURTEVANT UNIT VENTILATORS



Left. Manheim Township
Grade and Junior High School,
Neffsville, Pa.

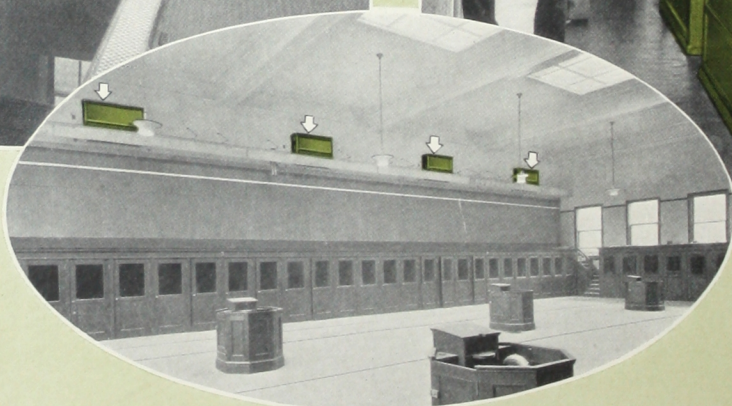
Below. New Court House
151st Street, New York
City



Above. Lincoln
Belmont Y.M.C.A.
Chicago, Ill.

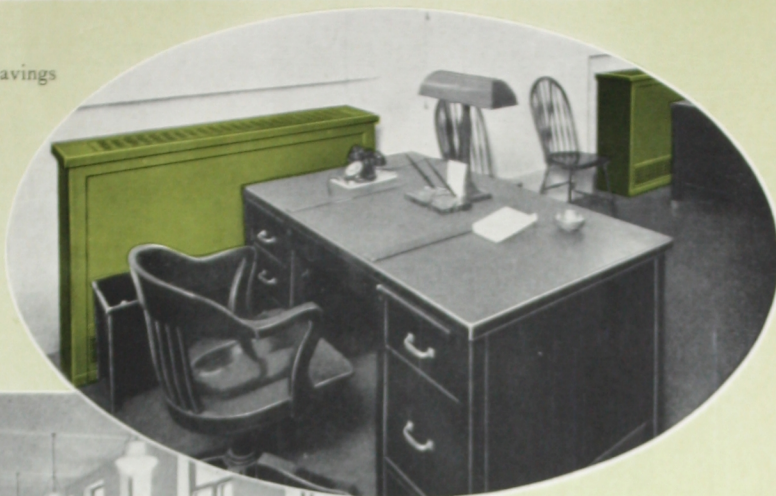


Above. Penna.
Bell Telephone Co.
Lancaster, Pa.



Stock Exchange, Toronto, Ont.

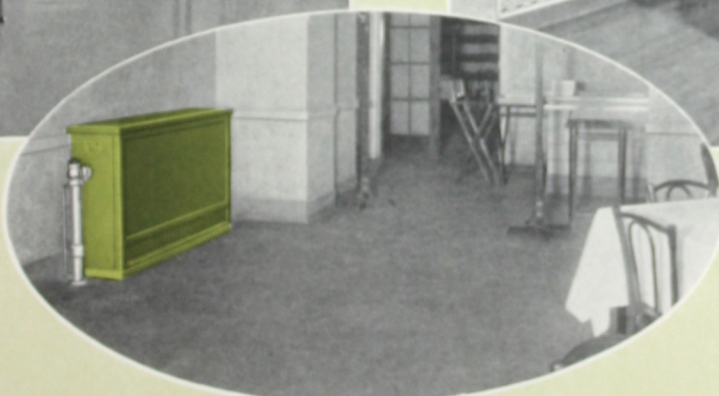
Right. Broadway Savings
Bank, Lawrence, Mass.



Below. New Court House
151st Street, New York
City.



Above. Penna.
Bell Telephone Co.
Lewiston, Pa.



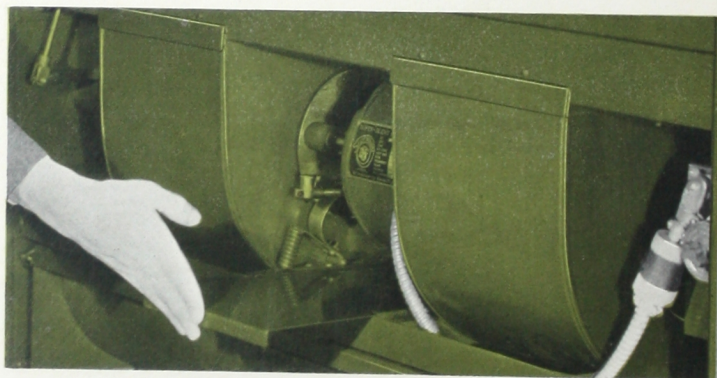
Above. Hotel
Bond, Hartford,
Conn.

Lincoln Belmont Y.M.C.A., Chicago, Ill.

The Unit for Partial Recirculation



Sturtevant Unit Ventilator arranged for 50 per cent recirculation.



Close-up showing slide that allows 50 per cent recirculation.

The streams of out-of-door and recirculated air are kept entirely apart until they reach the fans, thus preventing any possibility of cold outside air blowing through the recirculating grille of the unit. This is an important feature as it insures against cold drafts across the floor when there is a wind blowing into the fresh-air inlet.

Shall Any Room Air Be Recirculated?

LATEST scientific research shows that if adequate air motion is provided, the quantity of out-of-door air can be reduced without harmful effects. This does not mean that odors and disease germs can be eliminated from occupied space by merely stirring the atmosphere, and such a hypothesis is obviously unsound. Common sense and everyday experience make necessary the introduction of out-of-door air to displace and dilute the foul.

The minimum amount of air needed to provide proper distribution and even temperature is roughly double the amount necessary to provide purity. Hence some laws pertaining to ventilation have been changed and others are undergoing changes in many localities to permit of "50-50" operation, fifty per cent out-of-door air and fifty per cent recirculated air.

Sturtevant Unit Ventilators arranged for Partial Recirculation deliver a given, constant quantity of out-of-door air, and at the same time recirculate a portion of the room air. The purpose of this arrangement is to provide adequate motion, distribution, and purity without wasting heat by warming an unnecessary amount of out-of-door air. Compared with this arrangement, whereby all of the air is supplied from out-of-doors, this Partial Recirculation arrangement effects a considerable saving in fuel, and the quality of the room air is satisfactory, providing that the ventilating equipment selected is of the proper size.

The heating capacity of the "Sturtevant Unit for Partial Recirculation" is sufficient in most cases to supply all the heat necessary and to keep the ordinary school room or office warm in the coldest weather with

no auxiliary direct radiation. The first cost of a heating and ventilating system designed on this basis is, therefore, much lower than one designed for 100 per cent out-of-door air. Detailed data for enabling the engineer or architect to select unit ventilators of proper capacity is given on pages 24 to 30 inclusive of this catalog.

The unit can be easily arranged to supply all out-of-door air, if desired. When the inlet damper is closed so that no out-of-door air is admitted, the unit automatically becomes entirely recirculating, regardless of the adjustment of the partial recirculating feature.

This remarkable flexibility is an exclusive Sturtevant feature under a license agreement based on Page Patent, 1,760,166, together with certain features developed in Sturtevant Laboratories. The result is obtained by an ingenious arrangement of dampers and grilles which add slightly to the cost of the unit, but which is paid for many times over by reduced operating costs.

The recirculated air enters the cabinet through the grille in the center of the cabinet front and is drawn into the two center inlets to the fans. A sliding panel is so inserted between the two fan casings as to block off the flow of air to these inlets from out-of-doors. The out-of-door air flows in an unobstructed path from the wall inlet and through inlet damper to the two outer fan inlets; hence the unit delivers 50 per cent out-of-door air and 50 per cent recirculated air.

A filter for cleaning the air passing through the grille for partial recirculation can be provided on the inside of the cabinet door when desired.



The Non-Recirculating Unit Ventilator

FUNDAMENTALLY there is only one type of unit ventilator, but due to the various laws in the different states with regard to ventilation, we make three different standard arrangements of this one type. They are: the non-recirculating type, the one hundred per cent recirculating type, and the partial recirculating type. The only difference is in the cabinet fronts which are interchangeable, and, therefore, all three types are convertible from one type to another after installation. This convertible feature of the Sturtevant Unit Ventilator has a definite value that cannot be overlooked when Unit Ventilators are being selected.

The unit shown above is the non-recirculating type, with which it is impossible to recirculate any room air. The air is taken from the outside, passed through air intake damper and a filter, then up through the heating coils and out into the room.

It is designed to comply with those state codes with reference to school ventilation which prohibit recirculation at any time. Many of these codes are being revised to permit either partial recirculation during occupied periods or full recirculation for the purpose of quick and economical heating when room is unoccupied.



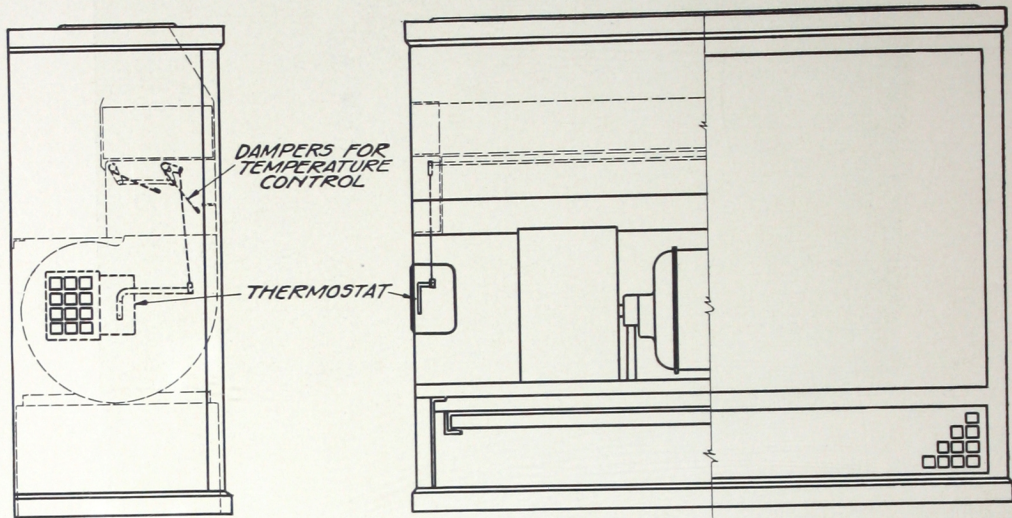
The Recirculating Unit Ventilator

THIS unit will supply all out-of-door air, or it will recirculate all room air. This latter feature is desirable in that it provides an economical means of heating during periods when room is unoccupied. It allows gravity recirculation of air when fans are not running, thereby providing enough heat to keep room above freezing temperature at night or over holidays. Forced recirculation with fans running is a quick method of heating up when the room is chilled due to a period of reduced heating. Of course, it is needless to say that all room air should not be recirculated under any conditions when the room is occupied.

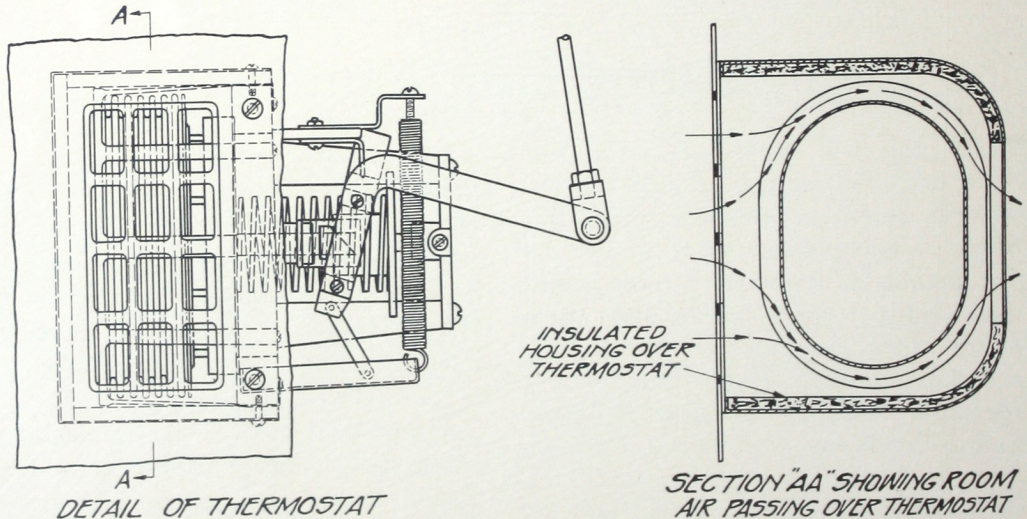
Every Sturtevant Unit Ventilator is provided with an intake damper for opening and closing the out-of-door inlet and at the same time closing or opening the recirculating inlet in the lower part of cabinet front. When intake is open, the recirculating inlet is closed — all air being taken from out-of-doors.

Intake dampers can be operated manually or by pneumatic control from a remote point. Sturtevant mounts, with the unit cabinets, the necessary attachments furnished by the manufacturer of the remote control instrument, whenever a system of this type is specified.

Sturtevant Automatic Temperature Regulator

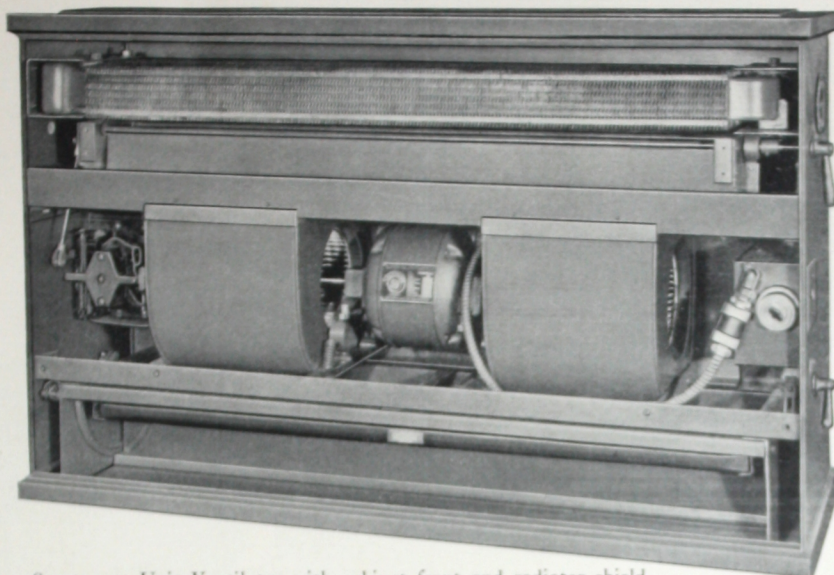


SKETCHES SHOWING APPLICATION OF STURTEVANT AUTOMATIC TEMPERATURE REGULATOR



The Thermostat of the Sturtevant Automatic Temperature Regulator operates from the expansion and contraction of a volatile liquid sealed within it. The fans of the unit ventilator draw a small stream of room air through the grille on the end of the cabinet and over the sensitive portion of the thermostat which moves the dampers for temperature control in a gradual manner, so as to provide the proper amount of heat. (Patent Pending)

The Thermostat can be set for any temperature between 62 and 78 degrees and will maintain the room temperature within less than two degrees of the setting providing there is no other uncontrolled source of heat in the room. The dampers are moved to the position to provide maximum heat when fans are not running.



Sturtevant Unit Ventilator with cabinet front and radiator shield removed, to show dampers for temperature control.

How Temperature Is Controlled

THE dampers above the fan outlets and directly below the heating surface control the temperature of the air leaving the unit ventilator so that it enters the room at the right degree for maintaining bodily health and comfort. Usually these dampers operate so as to temper the air by sending a portion through the heating surface and the remainder through the bypass unheated. The two streams mix just before passing through the discharge grille on cabinet top. When maximum heat is required all air passes through heating surface, and when no heat is required, all air is bypassed.

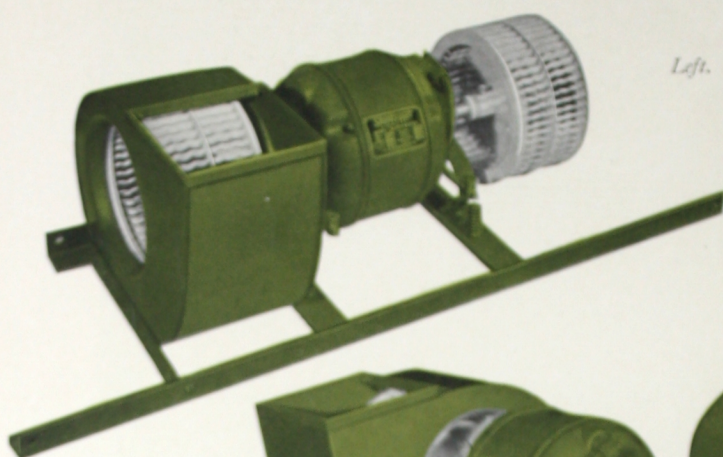
This method of heat control provides a good modulating effect, is simple to operate, and is responsive to automatic regulation. Positive, accurate, and reliable, the dampers can be operated by simple automatic mechanism so as to maintain desired room temperature within one or two degrees. Great care is taken in the building of the Sturtevant Unit Ventilator Temperature Dampers to insure free, easy movement. Bearings are bronze bushed, and all parts are exceptionally rugged.

Various methods of control may be applied

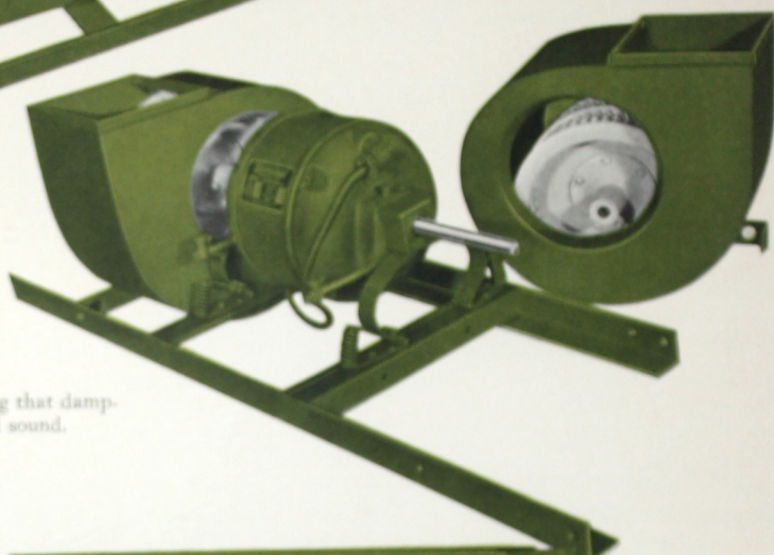
to the temperature dampers for maintaining a constant room temperature. Hand-control levers are regularly provided, but automatic control is recommended so as to relieve the room occupants from the annoyance of changing the damper settings as more or less heat is required. Automatic regulation saves fuel by preventing heat waste through overheating and is a valuable aid in maintaining bodily comfort.

Sturtevant Unit Ventilators can be provided with the Sturtevant Self-Contained Automatic Temperature Regulator requiring neither electric nor pneumatic connection and is extremely simple, sensitive, and reliable. The thermostatic element is mounted within the unit cabinet at the factory and is complete in itself. Many prominent installations operating for a period of years prove it to be lasting and dependable.

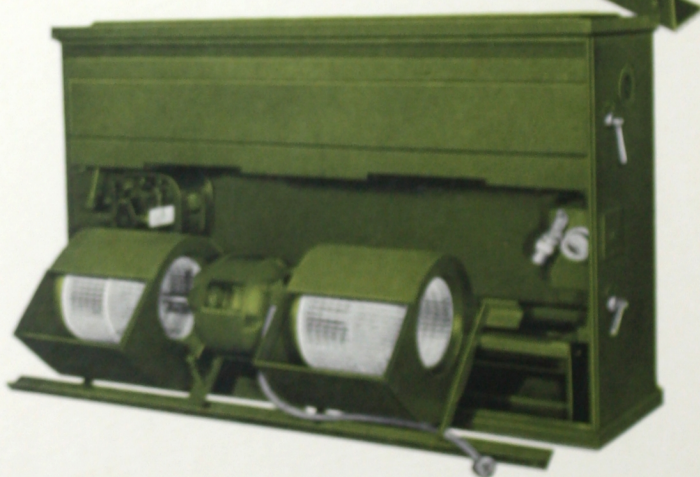
If the pneumatic or electric types of control are preferred, the necessary attachments of the particular make chosen will be mounted in the unit cabinets at the factory in accordance with agreements we have made with the several manufacturers.



Left. Motor and fan assembly with one fan casing removed.



Right. Spring mounting that dampens vibration and sound.



Above. Note how easily fan and motor assembly can be removed from the unit.

Sturtevant Multivane Fans and Super-Silent Motors

CENTRIFUGAL cased fans are used to draw air through the inlets and discharge it, after cleaning and warming, to the room.

Sturtevant-designed "Multivane" fans deserve special attention. So much depends on the fan in unit ventilation that the word "efficiency" must be thought of in its pure engineering sense in describing their function.

"Multivane" fans have maximum efficiency for unit ventilator application. In weight, balance, and blade curve they represent the latest developments in scientific accuracy. They are, undoubtedly, the best that can be bought — for they deliver a maximum of air at minimum current cost and sound. This is the basis of all fan efficiency.

The motor in a unit ventilator actually is the most important part. It is the heart of the device. Unless it functions silently, dependably, efficiently, the benefits and refinements of unit ventilation are curtailed, and the deserved progress of the idea as a whole is impeded.

It is impossible to hear the Sturtevant Super-Silent motor running in the unit when only three feet away — and in a quiet room! It is a Sturtevant-built motor throughout. No motor was available on the market that could meet the exacting specifications of our designers for quietness and dependability.

The motor frame is so mounted that there

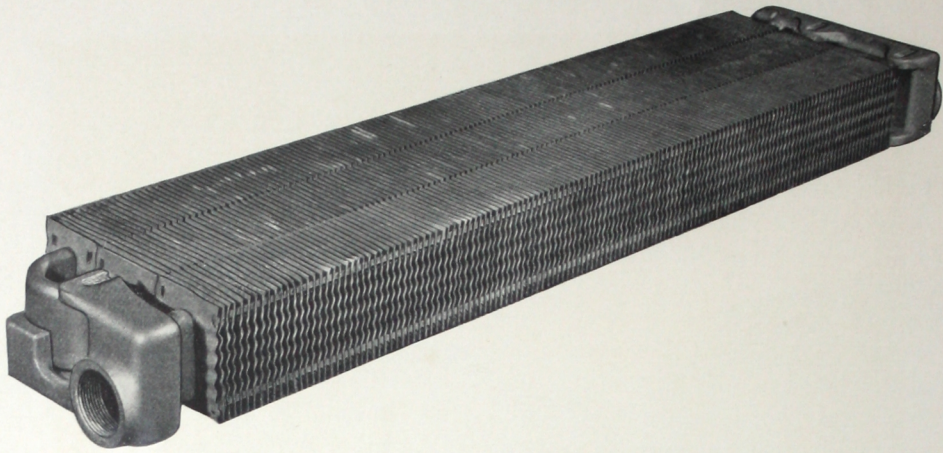
is no possibility of whipping of the fan wheels or of vibration. It is also entirely free from magnetic hum. The bearings are of phosphor bronze with an estimated life of twenty years . . . and guaranteed not to wear "noisy"! The oiling system is of the "wool packed" type. Each bearing housing is packed with first-quality, long-fibre, washed wool.

The oil reservoirs are exceptionally large — requiring oil very seldom.

The Super-Silent motors can be furnished for either polyphase or single-phase alternating current and are variable speed. Direct-current motors can be furnished when necessary and they are mechanically interchangeable. This interchangeability is a great advantage where there is possibility of a change in current conditions at any future time.

All types are silent. The single-phase motors are of the "condenser" type — so designed that automatic cut-outs and brushes, until recently necessary on split-phase motors, are eliminated.

Another important feature of the "Super-Silent" motor is its low starting current. This but slightly exceeds the running current. Usually a split-phase motor has a starting current which draws up to five times the running current. Consequently, electric light "flicker" and interference with radio reception caused by starting this old type are eliminated in the Sturtevant "Super-Silent" type.



The Heating Surface

THE heating surface used in the Sturtevant Unit Ventilator is made especially for this product. It is a light-weight, extended-surface type heating element, intended for use with steam at pressures between 0 and 35 pounds or with hot water. However, a factory steam test of 75 pounds pressure is applied to every section before shipping. There is no distortion of any kind at this pressure,—at least 1500 pounds hydrostatic pressure is required to burst a section.

This heating element is constructed of a non-ferrous metal (copper and copper alloys) and is coated with lead. The element is non-corrosive under all ordinary conditions; it resists the corrosive action of acids and alkali.

The steam or water passage is one continuous piece of drawn bronze tubing $2\frac{1}{2}'' \times 1\frac{1}{2}''$ inside. It is bent twice to the shape of an elongated "S", so that expansion

and contraction can take place without strain on any part.

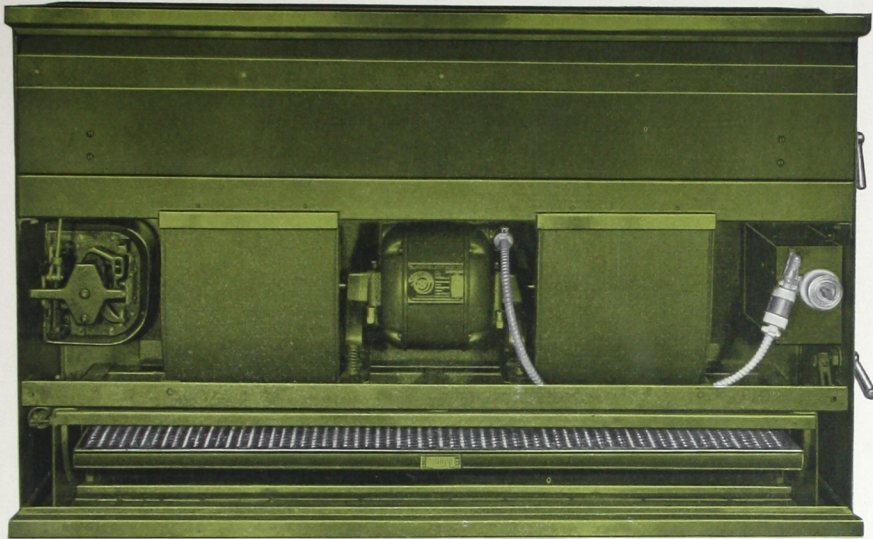
The extended surfaces or the "fins," are fastened to the tube in such a manner that neither expansion, contraction, nor corrosion can break the contact or prevent perfect heat transfer. It is not damaged by freezing, the most severe test that can be devised.

The air passing over the fins is baffled by corrugations in these fins and maximum heating effect is obtained.

Free steam passage, provision for draining and expansion, ruggedness and efficiency make this heating surface ideal for the Sturtevant Unit Ventilator.

The table of capacities in the Engineering Section following provides the architect, engineer, and contractor with a basis on which to figure the equivalent of direct radiation of Sturtevant Unit Ventilators utilizing this heating surface.

Air Filters



Sturtevant Unit Ventilator showing air filter partly removed.

THE Air Filters provided in Sturtevant Unit Ventilators have one, and only one, duty, that is, to provide Air Purity to incoming air. Under ordinary conditions they will



remove practically all of the dust and dirt carried by the air brought into the units. These filters are manufactured for us by the leading manufacturer of this type of equipment.

On this page we show an actual photograph of one pound of atmospheric dust. It was taken out of air filters in ventilating service and reclaimed by the manufacturer's research department in an effort to find out the physical make up and cubical volume of a pound of air dust. The handfuls and overflow piles constitute one pound.

The filters regularly furnished are of the all-metal oil type. They leave the Sturtevant factory charged with an odorless filter oil and are ready for immediate service. The only maintenance required is an occasional washing of the filters to remove the accumulated dirt, and recharging with filter oil, which is fireproof and a powerful germicide.

There are many special installations in hospitals, telephone exchanges, and factories where the efficiency in the removal of germs and bacteria is over 99 per cent. This extraordinary performance is achieved by increasing the thickness of the filters, which can be done in connection with the special unit ventilators shown on page 22.

Filtered Air as a Treatment of Allergic Diseases (Hay-fever, Bronchial Asthma, etc.)

MEDICAL authorities in this country and abroad now believe that practically all cases of seasonal hay fever are caused by air-borne irritants, such as weed or tree pollens and similar protein impurities. Air-borne factors of this type cause 90 per cent of hay fever throughout the United States. In asthma the percentage varies from 30 to 40 per cent in the northern states, to an excess of 90 per cent in the southern and western.

It has been found by experiment that many sufferers obtain relief by remaining for a few hours in rooms ventilated by thoroughly filtered air. Sleeping in such a chamber may enable the patient to carry on his daily work without hay-fever symptoms for a considerable period of time.

If similar provision for ventilating is made in the office or place of employment, the sufferer may obtain twenty-four-hour relief.

A Sturtevant Unit Ventilator complete with the special hay-fever filter in the bedroom or office provides fresh air with irritating dusts removed. It is unnecessary to attempt to make the rooms air tight other than to close the doors and windows. Sufficient air is delivered to create a slight pressure in the room, thus any leakage is from the room out, preventing infiltration of untreated air.

The unit may be installed in place of a direct radiator, and will provide an efficient means of heating when not needed for ventilation.

Hay-Fever Resorts

(Reprinted by permission of American Air Filter Company, Inc.)

FROM the time of our earliest knowledge of hay fever and asthma, they were recognized as "diseases of climate," and relief was sought by travel. In this manner some localities were developed as hay-fever resorts, sufferers with sufficient means making it a practice to spend the hay-fever season at these favored spots. This, of course, is an expensive and often inconvenient procedure beyond the reach of many persons.

Recent medical literature has contributed much to our knowledge of this subject. In his recent work on allergic diseases, Dr. W. Storm Van Leeuwen of Leiden, Holland, states: "Our first publication on a miasm-free room was made in April, 1924 (Proc. Royal Sec. of Medic., Vol. xvii). The principles laid down in that publication have been worked out so completely that

we have opened a clinic for allergic diseases in Leiden, based entirely on the principle of pure air treatment in miasm-proof chambers. Moreover we have already induced a number of patients to have a small miasm-free chamber built in their own bedrooms, in order that pure air treatment can be applied at home. The results of this treatment have by far exceeded our expectations." He discusses the effectiveness of this treatment, and states that when without the patients' knowledge the filtration of the air was defective, attacks reoccurred. "One day the motor which worked the ventilation of the room was defective. Twenty-four hours later the child had asthmatic attacks every two hours. After the repair of the motor she returned to her original condition again in three days."

The Humidifier

LACK of sufficient moisture in the air at ordinary room temperatures causes an unpleasant sensation of coolness due to the rapid rate at which perspiration is absorbed from the skin. The membranes of the nose and throat become parched and dry and people are more susceptible to respiratory diseases. It is generally agreed that the relative humidity indoors at 70 degrees should be between 30 and 50 per cent. Forty per cent is the practical limit as condensation forms on windows and walls in moderately cold weather if the relative humidity exceeds this amount.

Experiments have indicated that artificial humidification is rarely necessary in schools, although it may be desirable where ex-

tremely cold weather is encountered for considerable periods of time or where the climate is exceptionally dry.

Sturtevant Unit Ventilators may be provided with humidifiers as an accessory. The type regularly furnished consists of a perforated tube covered with an absorbent material. The tube is mounted in the cabinet of the unit ventilator directly above the heating surface and is arranged for connection to the steam supply. The steam moistens the absorbent covering and the moisture is taken up by the air delivered to the room.

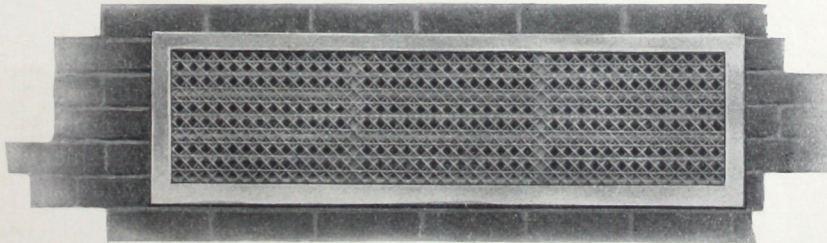
The humidifier is self-cleaning, noiseless, effective, simple in construction, easily controlled, low in cost, and requires no maintenance.

The Fresh-Air Inlet

AS its name implies, the fresh-air inlet is that part of the unit which extends through the wall and is the means of the fresh air entering the unit. Because of the fact that it usually is built into the building, becoming an integral part of it, the inlet should be built of only the best materials. One thing in particular it should not do is rust. The rust will not only

weaken the construction, but will also stain the building.

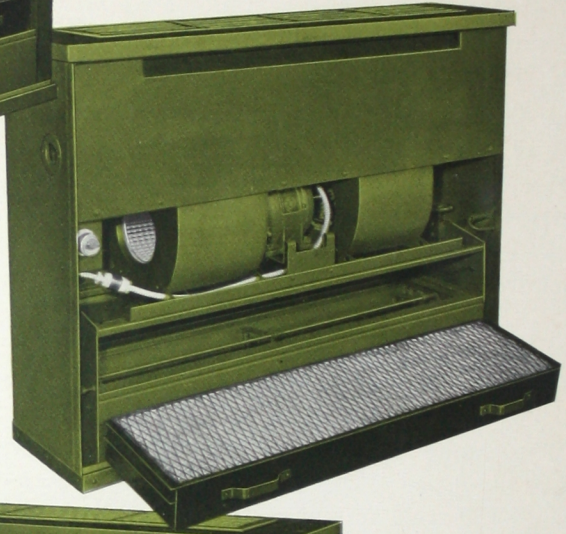
The inlet furnished with the Sturtevant unit is made entirely of copper and bronze. The Metalace screen on the face of the inlet prevents the accumulation of leaves and other matter, and when the inlet is installed as recommended, there is no shelf or offset on which birds may perch or nest.



Unit Ventilators for Telephone Exchanges



Left. Telephone type Sturtevant Unit Ventilator with front removed and filter in place.



Right. This view shows the extra-thick air filter for high cleaning efficiency.



Above. Telephone type unit with cabinet front in place.

Of Interest to the Architect and Engineer

THE Unit Ventilator is essentially an engineering type of apparatus. It is built to meet specifications. The B. F. Sturtevant Company offers a complete line of standard sizes and a flexible type of standard construction, which permits the apparatus to be installed in a variety of different ways which are listed on the following pages as "arrangements." The outline drawings which follow show the arrangements that meet typical requirements and which can be furnished promptly and at lowest cost.

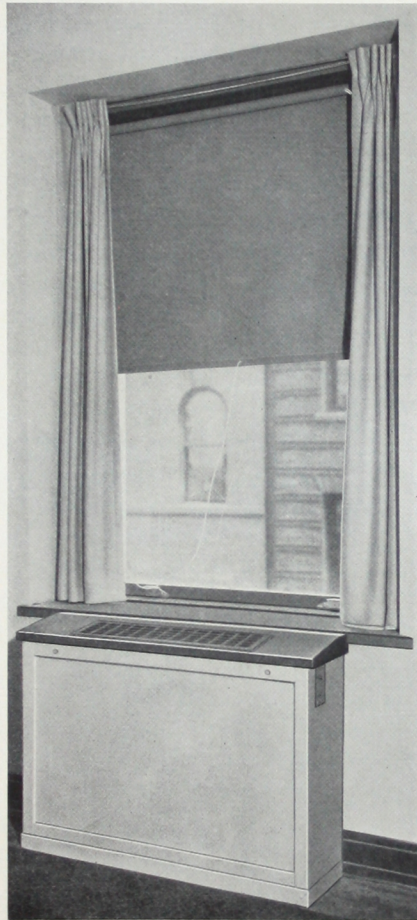
Sturtevant invites architects and engineers to submit to its representatives their special problems with reference to unit ventilators, when it is necessary to design them to conform exactly to requirements of a particular building or service. Many outstanding installations have been made on this basis, and the results have been a matter of pride with all concerned.

There are 90 units in the monumental City Bank and Farmers Trust Company's Building near

the New York City Stock Exchange. These units were designed for small private offices and are, therefore, smaller in capacity than standard. The architect, the engineer, and Sturtevant co-operated for the

purpose of securing ventilating equipment to harmonize with architectural details, and to function properly in conjunction with unusual conditions.

The special unit ventilators for the telephone exchange, shown on the opposite page, were designed in accordance with the specifications of the consulting engineer, and engineers of the Pennsylvania Bell Telephone Company. The dial exchanges for which they are intended must be as free from dust as it is possible to make them, so air-cleaning efficiency is a most important requirement of the ventilating system. The highly efficient filters and the manner in which they are mounted are the principal features of this special design which can be furnished for all similar applications. Full details furnished on request.



Special Sturtevant Unit Ventilator in Typical Small Office of the City Bank and Farmers Trust Building, New York City

Hints on Layout of Unit Heating and Ventilating Systems

PROPER diffusion of air requires that the volume of air supplied per hour to any given room shall be equivalent to at least five, and preferably six, times the volume of that room (five or six air changes). The laws of good ventilation demand that a minimum of 15 cubic feet of out-of-door air and a maximum of 30 cubic feet, should be supplied per minute per person. With this information it is possible to check the ventilating requirements by figuring two ways. Thus, if it is desired to find out the proper size of a unit ventilator for an office 50 feet long by 20 feet wide and 12 feet high, which will be occupied by forty people, the following calculations will form a basis for selecting suitable equipment.

The volume of the room is $50 \times 20 \times 12$, or 12,000 cubic feet. Then, if the room is to be given six changes of air per hour, we multiply $6 \times 12,000$, which is 72,000 cubic feet of air per hour, or 1200 cubic feet per minute. This is the amount the unit ventilator should deliver.

The other method of figuring the necessary air supply is as follows: forty people require a minimum of 600 cubic feet of out-of-door air (40×15) per minute, and a maximum of 1200 (40×30), so that a size 1200 Unit Ventilator is adequate. It will probably be found that a Sturtevant Unit Ventilator arranged for Partial Recirculation, so that 600 cubic feet are introduced from out-of-doors and 600 cubic feet are recirculated, will adequately heat the space without the addition of direct radiation.

Laws or regulations usually set the ventilation requirements for schools, particularly school classrooms. The example given above covers the minimum practice for school ventilation and is a safe basis where there are no laws governing.

The amount of air that can be properly distributed from a single point is limited by the ceiling height. Unless the ceiling height is greater than 12 or 13 feet, it is best not to provide for unit ventilators larger than size 1500 (1500 cubic feet per minute). The larger units can be used to advantage in gymnasiums, auditoriums, and similar spaces where the ceiling height is 15 feet or more.

Unit Ventilators for offices and classrooms should be located centrally (or symmetrically where there is more than one), on the outside wall of the room they serve. Corner locations are to be avoided for the reason that unbalanced and inefficient distribution is likely to result. Auditoriums and gymnasiums into which air is discharged in a horizontal direction by means of large-capacity units should be treated as individual problems, and the arrangement of the apparatus is best left to the judgment of the engineer.

Unit Ventilators may be recessed, but they ought not to be enclosed or concealed. Enclosures are liable to effect diffusion, and they interfere with proper attention and care by rendering the machine inaccessible. The exposed unit has a psychological value in that the occupants quickly learn its purpose and operation, with the result that

its value is appreciated and it is, therefore, properly cared for.

One of the principal advantages of the unit system of heating and ventilating is the fact that every room is heated and ventilated independently of any other room; no single unit should be made to serve more than one room by the extension of ducts from the outlet.

The unit system requires no special treatment of vent flues; exhaust fans are neither necessary nor desirable. Vitiated air may be discharged through corridors to a central outlet if desired, or through individual room vents. One vent for each unit is sufficient, and both grille and flue should have an area of about 18 inches for each 100 cubic feet of air delivered into the room from out-of-doors per minute.

Unit Ventilators perform most satisfactorily when controlled automatically and

permitted to heat as well as ventilate. Some direct radiation may be necessary to supplement the heat furnished by non-recirculating and recirculating units in extreme weather and during unoccupied periods, but there is rarely any reason to include it when the units operate partially recirculating during occupied periods. It is proper to arrange any system of automatic control so that the direct radiation acts as a reserve and supplies heat only when room is several degrees cooler than desired.

Sturtevant Unit Ventilators are such an excellent means of heating that they are sometimes installed for heating only where ventilating is unnecessary. An even temperature, more comfortable conditions, and better control are provided in this way, and there is a saving in space required and in fuel costs.

These notes refer to the tables on pages 26, 27, 28, and 29

E. D. R. (Equivalent Direct Radiation) may be expressed in B. T. U. (British Thermal Units) by multiplying by 240.

Heating E. D. R. is the amount of heat which may be obtained by the use of the Unit Ventilator for balancing the transmission losses of the building.

Ventilating E. D. R. is the amount of heat required to raise the temperature of the entering air to 70 degrees.

Total E. D. R. is the sum of Heating and Ventilating E. D. R.

Final temperature is the maximum temperature of the discharged air. Any lesser temperature (higher than that of the entering air) may be obtained by means of the dampers for temperature control within the Unit Ventilator.

Heating Capacities — Table I

STURTEVANT UNIT VENTILATORS — MODEL 31

Room Temp.

70°

Partially Recirculating Type

50 per cent out-of-door air

50 per cent recirculated air

Steam 5 pounds pressure

All arrangements, sizes 450 to 1750

SIZE C. F. M.	SQUARE FEET EQUIV. DIRECT RADIATION	TEMPERATURE OF OUT-OF-DOOR AIR — DEGREES F.								
		-10	0	10	20	30	40	50	60	70
450	Heating.....	139	140	142	146	150	151	153	155	158
	Ventilating.....	87	75	63	52	42	31	20	10	...
	Total.....	226	215	205	198	192	182	173	165	158
	Final Temperature.	133	135	136	138	141	142	144	146	148
600	Heating.....	181	183	186	192	198	200	202	205	209
	Ventilating.....	115	100	85	70	56	41	27	13	...
	Total.....	296	283	271	262	254	241	229	218	209
	Final Temperature.	131	133	135	137	140	141	143	145	147
750	Heating.....	211	214	218	226	234	238	242	246	250
	Ventilating.....	144	125	106	88	70	52	34	17	...
	Total.....	355	339	324	314	304	290	276	263	250
	Final Temperature.	127	129	131	133	136	138	140	142	144
900	Heating.....	236	243	250	257	264	270	276	284	292
	Ventilating.....	173	150	127	105	83	62	41	20	...
	Total.....	409	393	377	362	347	332	317	304	292
	Final Temperature.	123	125	128	130	132	134	137	139	142
1050	Heating.....	261	269	277	287	297	305	313	320	328
	Ventilating.....	202	175	148	123	98	72	47	24	...
	Total.....	463	444	425	410	395	377	360	344	328
	Final Temperature.	120	122	125	127	130	132	135	137	139
1200	Heating.....	307	317	327	339	352	357	362	373	383
	Ventilating.....	230	200	169	140	111	82	54	27	...
	Total.....	537	517	496	479	463	439	416	400	383
	Final Temperature.	122	124	127	129	132	134	136	138	141
1350	Heating.....	330	333	356	370	384	393	402	412	421
	Ventilating.....	260	225	190	157	125	93	61	30	...
	Total.....	590	558	546	527	509	486	463	442	421
	Final Temperature.	120	122	125	127	130	132	135	137	139
1500	Heating.....	346	363	380	395	411	421	432	443	454
	Ventilating.....	288	250	212	175	139	103	68	34	...
	Total.....	634	613	592	570	550	524	500	477	454
	Final Temperature.	117	120	123	125	128	130	133	135	137
1750	Heating.....	360	378	397	412	427	441	455	472	488
	Ventilating.....	336	289	242	203	163	121	80	40	...
	Total.....	696	667	639	615	590	562	535	512	488
	Final Temperature.	112	114	117	119	122	124	127	129	132

See notes page 25

Heating Capacities — Table II

STURTEVANT UNIT VENTILATORS — MODEL 31

Room Temp.

70°

Recirculating and Non-Recirculating Types

Table for 100 per cent out-of-door air

Steam 5 pounds pressure

All arrangements, sizes 450 to 1750

SIZE C. F. M.	SQUARE FEET EQUIV. DIRECT RADIATION	INLET AIR TEMPERATURE — DEGREES F.								
		-10	0	10	20	30	40	50	60	70
450	Heating.....	108	123	126	135	139	142	150	153	158
	Ventilating.....	187	161	136	110	87	63	42	20	...
	Total.....	295	284	262	245	226	205	192	173	158
	Final Temperature.	117	122	125	129	133	136	141	144	148
600	Heating.....	139	155	165	174	181	186	198	202	209
	Ventilating.....	250	215	181	147	115	85	56	27	...
	Total.....	389	370	346	321	296	271	254	229	209
	Final Temperature.	114	119	123	127	131	135	140	143	147
750	Heating.....	154	173	190	203	211	218	234	242	250
	Ventilating.....	313	269	226	183	144	106	70	34	...
	Total.....	467	442	416	386	355	324	304	276	250
	Final Temperature.	108	114	119	123	127	131	136	140	144
900	Heating.....	167	188	212	226	236	250	264	276	292
	Ventilating.....	375	322	271	220	173	127	83	41	...
	Total.....	542	510	483	446	409	377	347	317	292
	Final Temperature.	105	109	115	119	123	128	132	137	142
1050	Heating.....	166	194	221	240	261	277	297	313	328
	Ventilating.....	439	376	316	256	202	148	98	47	...
	Total.....	605	570	537	496	463	425	395	360	328
	Final Temperature.	100	105	110	115	120	125	130	135	139
1200	Heating.....	215	245	278	293	307	327	352	362	383
	Ventilating.....	500	430	361	293	230	169	111	54	...
	Total.....	715	675	639	586	537	496	463	416	383
	Final Temperature.	104	109	114	118	122	127	132	136	141
1350	Heating.....	220	260	280	313	330	356	384	402	421
	Ventilating.....	564	474	410	329	262	190	125	61	...
	Total.....	784	734	690	642	592	546	509	463	421
	Final Temperature.	101	105	111	115	120	125	130	135	139
1500	Heating.....	211	256	291	322	346	380	411	432	454
	Ventilating.....	625	537	451	366	288	212	139	68	...
	Total.....	836	793	742	688	634	592	550	500	454
	Final Temperature.	97	102	107	112	117	123	128	133	137
1750	Heating.....	165	242	276	323	360	397	427	455	488
	Ventilating.....	730	625	525	427	336	242	163	80	...
	Total.....	895	867	801	750	696	639	590	535	488
	Final Temperature.	89	96	101	106	112	117	122	127	132

See notes page 25

Heating Capacities — Table III

STURTEVANT UNIT VENTILATORS — MODEL 31

Room Temp.

70°

Partially Recirculating Types

50 per cent out-of-door air

50 per cent recirculated air

Steam 5 pounds pressure

Arrangements 1, 7, 8, 9 — sizes 2000 to 4000 c. f. m.

SIZE C. F. M.	SQUARE FEET EQUIV. DIRECT RADIATION	TEMPERATURE OF OUT-OF-DOOR AIR — DEGREES F.								
		-10	0	10	20	30	40	50	60	70
2000	Heating.....	516	534	553	568	584	599	613	628	642
	Ventilating.....	384	333	282	234	186	138	91	45	....
	Total.....	900	867	835	802	770	737	704	673	642
	Final Temperature.	122	124	127	129	132	134	137	139	141
2500	Heating.....	570	594	618	638	658	679	701	723	746
	Ventilating.....	480	416	352	292	232	173	114	57	....
	Total.....	1050	1010	970	930	890	852	815	781	746
	Final Temperature.	116	118	121	123	126	128	131	133	136
3000	Heating.....	625	656	687	705	732	758	785	815	844
	Ventilating.....	575	499	423	350	278	207	137	68	....
	Total.....	1200	1155	1110	1055	1010	965	922	883	844
	Final Temperature.	112	114	117	119	122	124	127	129	132
3500	Heating.....	608	642	696	740	785	818	851	884	917
	Ventilating.....	672	588	494	410	325	242	159	80	....
	Total.....	1280	1230	1190	1150	1110	1060	1010	964	917
	Final Temperature.	105	108	111	114	117	120	123	125	128
4000	Heating.....	852	897	941	980	1018	1050	1083	1119	1155
	Ventilating.....	768	666	564	468	372	277	182	91	....
	Total.....	1620	1563	1505	1448	1390	1327	1265	1210	1155
	Final Temperature.	113	116	119	121	124	126	129	131	134

See notes page 25

Heating Capacities — Table IV

STURTEVANT UNIT VENTILATORS — MODEL 31

Room Temp.

70°

Recirculating and Non-Recirculating Types

Table for 100 per cent out-of-door air

Steam 5 pounds pressure

Arrangements 1, 7, 8, 9 — sizes 2000 to 4000 c. f. m.

SIZE C. F. M.	SQUARE FEET EQUIV. DIRECT RADIATION	INLET AIR TEMPERATURE — DEGREES F.								
		-10	0	10	20	30	40	50	60	70
2000	Heating.....	346	410	448	489	516	553	584	613	642
	Ventilating.....	834	715	602	488	384	282	186	91	....
	Total.....	1180	1125	1050	977	900	835	770	704	642
	Final Temperature.	103	109	113	118	122	127	132	137	141
2500	Heating.....	337	415	476	520	570	618	658	701	746
	Ventilating.....	1043	895	754	610	480	352	232	114	....
	Total.....	1380	1310	1230	1130	1050	970	890	815	746
	Final Temperature.	96	101	106	111	116	121	126	131	136
3000	Heating.....	304	412	495	560	625	687	732	785	844
	Ventilating.....	1251	1072	905	730	575	423	278	137	....
	Total.....	1555	1484	1400	1290	1200	1110	1010	922	844
	Final Temperature.	89	96	101	106	112	117	122	127	132
3500	Heating.....	232	355	460	535	608	696	785	851	917
	Ventilating.....	1460	1250	1050	855	672	494	325	159	....
	Total.....	1692	1605	1510	1390	1280	1190	1110	1010	917
	Final Temperature.	83	88	95	100	105	111	117	123	128
4000	Heating.....	454	598	676	784	852	941	1018	1083	1155
	Ventilating.....	1668	1432	1204	976	768	564	372	182	....
	Total.....	2122	2030	1880	1760	1620	1505	1390	1265	1155
	Final Temperature.	92	98	103	108	113	119	124	129	134

See notes page 25

Use of Capacity Tables

Air Volume

SELECT the size of unit ventilator on the basis of volume of air required. It may be found that the heating requirements are thereby adequately provided for, or that a small increase in the size of unit will take care of them. (See Hints on Layout of Unit Heating and Ventilating Systems, page 24.)

Heating Capacities

Figure first the amount of heat necessary to warm the room during the coldest weather usually encountered in the locality. (See "American Society of Heating and Ventilating Engineers Guide" for method of figuring the heat losses from buildings.) If the result is expressed in B. T. U. (British Thermal Units), divide by 240 to obtain the equivalent in square feet of radiation. Refer to the table showing data for the size and type of unit to be used, and under the column for the entering air temperature corresponding to climatic conditions find the heating capacity, ventilating capacity, and total or sum of these two quantities.

It is well to provide some direct radiation where the unit is of the non-recirculating type; radiation equivalent to one-third or one-half of the transmission losses is recommended in this case. If the heating capacity is greater than the heat transmission losses, direct radiation is not required with the other types.

The ventilating capacity shows the amount of heat required to raise the temperature of the out-of-door air to room temperature. The difference between the ventilating capacities of the recirculating (or non-recir-

culating) and the partial recirculating types, is indicative of the fuel saving to be realized by the use of the latter.

Example: A size 1200 unit for -10 degree entering air is to be used. The average temperature for the heating season where transmission losses are figured for -10 out-of-door temperature is usually 30 to 35 degrees. The heating season for a school is roughly 160 days per year, allowing for vacations and five days a week. Assuming that the building is ventilated seven hours daily, the total time is 160×7 , or 1120 hours.

The ventilating capacity of a non-recirculating type of unit, size 1200, is equivalent to 230 square feet of radiation with 30 degrees entering air. The ventilating capacity of the partially recirculating type is 111 square feet; the difference is 119 square feet or 240×119 , or 28,560 B. T. U. per hour, or $1120 \times 28,560$ equals 31,987,200 B. T. U. for the heating season.

Assuming that coal is used for fuel and that it has a heat value of 12,000 B. T. U. per pound, and that the boiler efficiency is 60 per cent, the saving is:

$$\frac{31,987,200}{12,000 \times .60} = 4443 \text{ pounds of coal saved.}$$

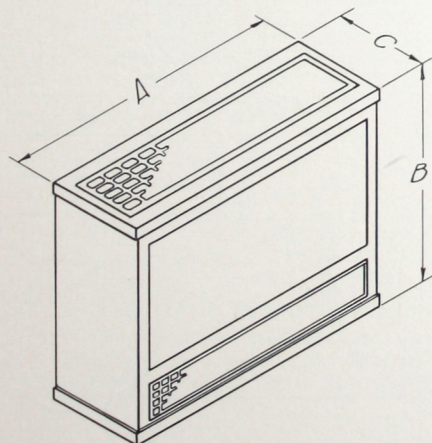
If the coal cost \$6.00 per ton, then the saving is $\frac{4443}{2000} \times \6.00 or \$13.33 per unit per season.

The boiler load of a unit ventilator is the sum of ventilating capacity and the heat transmission losses. The greatest possible boiler load is the total capacity shown in the tables, ventilating capacity plus heating capacity.

READY REFERENCE FOR ENGINEERS

STURTEVANT UNIT VENTILATORS

SIZE OF UNIT C.F.M.	TO SELECT SIZE OF UNIT		HORSE POWER RATING OF MOTOR	SIZE OF STEAM	SIZE OF RETURN	CABINET OVERALL ARRANGEMENT #1			SIZE OF WALL BOX	SIZE OF WALL OPENING	HEATING CAPACITIES BASIS ZERO ENTERING AIR 50°F. EQUIVALENT RADIATION								
	BASIS 6 AIR CHANGES PER HOUR VOLUME OF ROOM CUB. FT.	BASIS NO. OF PERSONS 30 C.F.M. PER PERSON				A	B	C			50% RECIRC. AIR, 50% OUT OF DOOR AIR			100% OUT OF DOOR AIR					
											WIDTH	HEIGHT	DEPTH	HEATING	VENT'G	TOTAL	HEATING	VENT'G	TOTAL
450	4500	15	$\frac{1}{10}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$41\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 33\frac{3}{4}$	10×34	140	75	215	123	161	284			
600	6000	20	$\frac{1}{10}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$41\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 33\frac{3}{4}$	10×34	183	100	283	155	215	370			
750	7500	25	$\frac{1}{10}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$41\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 33\frac{3}{4}$	10×34	214	125	339	173	269	442			
900	9000	30	$\frac{1}{6}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$41\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 33\frac{3}{4}$	10×34	243	150	393	188	322	510			
1050	10500	35	$\frac{1}{6}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$41\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 33\frac{3}{4}$	10×34	269	175	444	194	376	570			
1200	12000	40	$\frac{1}{6}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$51\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 41\frac{1}{4}$	10×42	317	200	517	245	430	675			
1350	13500	45	$\frac{1}{6}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$51\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 41\frac{1}{4}$	10×42	333	225	558	260	474	734			
1500	15000	50	$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$51\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 41\frac{1}{4}$	10×42	363	250	613	256	537	793			
1750	17500	58	$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$51\frac{1}{4}$	32	$14\frac{3}{8}$	$9\frac{3}{4} \times 41\frac{1}{4}$	10×42	378	289	667	242	625	867			
2000	20000	67	$\frac{1}{3}$	2	2	$61\frac{1}{4}$	42	$20\frac{1}{4}$	$15\frac{1}{2} \times 49\frac{1}{2}$	$15\frac{3}{4} \times 49\frac{1}{2}$	534	333	867	410	715	1125			
2500	25000	83	$\frac{1}{3}$	2	2	$61\frac{1}{4}$	42	$20\frac{1}{4}$	$15\frac{1}{2} \times 49\frac{1}{2}$	$15\frac{3}{4} \times 49\frac{1}{2}$	594	416	1010	415	895	1310			
3000	30000	100	$\frac{1}{3}$	2	2	$61\frac{1}{4}$	42	$20\frac{1}{4}$	$15\frac{1}{2} \times 49\frac{1}{2}$	$15\frac{3}{4} \times 49\frac{1}{2}$	656	499	1155	412	1072	1484			
3500	35000	117	$\frac{1}{3}$	2	2	$61\frac{1}{4}$	42	$20\frac{1}{4}$	$15\frac{1}{2} \times 49\frac{1}{2}$	$15\frac{3}{4} \times 49\frac{1}{2}$	642	588	1230	355	1250	1605			
4000	40000	134	$\frac{1}{2}$	2	2	$61\frac{1}{4}$	52	$25\frac{1}{4}$	$21\frac{1}{2} \times 49\frac{1}{2}$	$26\frac{1}{2} \times 49\frac{1}{2}$	897	666	1563	598	1432	2030			



SUGGESTED METHOD OF ANEMOMETER TEST TO DETERMINE VOLUME OF AIR DELIVERED BY A UNIT VENTILATOR IS AS FOLLOWS:

1. DIVIDE THE SURFACE OF THE DISCHARGE GRILLE INTO A NUMBER OF EQUAL AREAS APPROXIMATELY SIX INCHES SQUARE.
2. HOLD THE ANEMOMETER IN CONTACT WITH THE GRILLE IN THE CENTER OF EACH AREA FOR A PERIOD OF TIME SUFFICIENT TO INSURE AN AVERAGE READING.
3. AVERAGE THE READINGS AND OBTAIN RESULT IN TERMS OF VELOCITY IN FEET PER MINUTE.
4. MULTIPLY THE AVERAGE VELOCITY BY THE MEAN OF THE GROSS AREA AND NET FREE AREA OF THE GRILLE IN SQUARE FEET AND OBTAIN VOLUME DELIVERY IN CUBIC FEET OF AIR PER MINUTE

$$C.F.M. = CV \frac{A+a}{2}$$

C = GRILLE CONSTANT (97 LOW VEL., 100 HIGH VEL.)

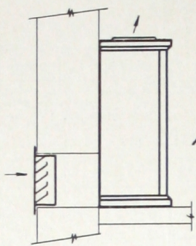
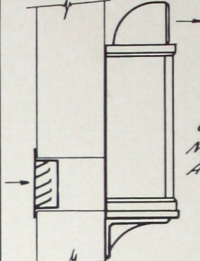
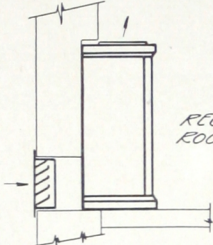
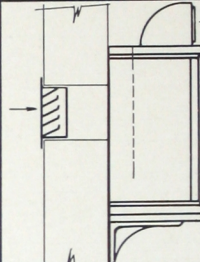
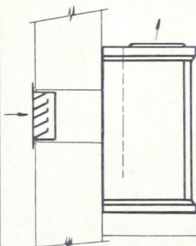
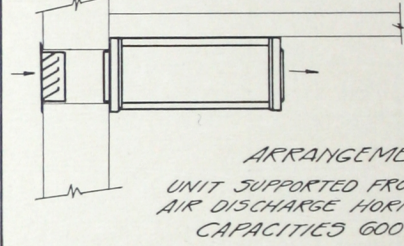
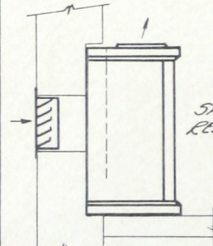
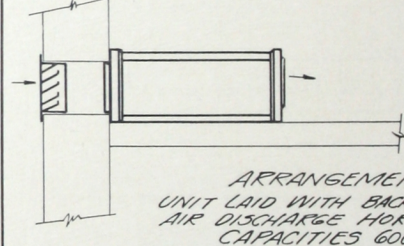
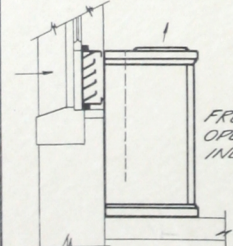
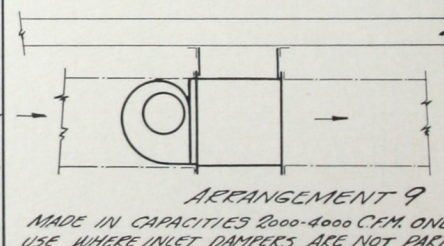
V = VELOCITY, FEET PER MINUTE.

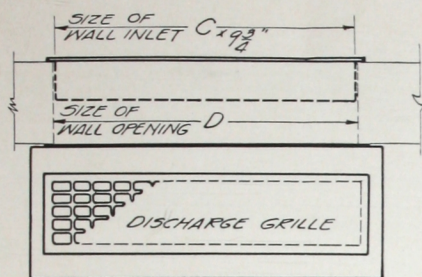
A = GROSS AREA OF GRILLE 50 FT.

a = NET FREE AREA OF GRILLE 50 FT.

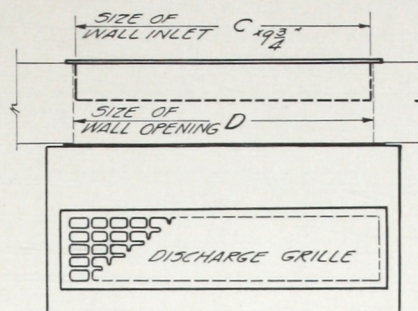
(FROM A.S.H.+V.E. GUIDE 1931-CHAPTER 31)

KEY TO ARRANGEMENTS

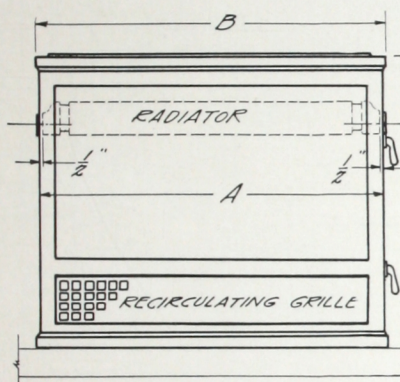
 ARRANGEMENT 1 FRESH AIR INLET AT OR NEAR FLOOR PERMITS USE OF SIMPLEST TYPE CAPACITIES 600-4000 C.F.M.	 ARRANGEMENT 5 USED WHERE UNIT MUST BE MOUNTED HIGH ABOVE FLOOR AIR DISCHARGE IS HORIZONTAL CAPACITIES 600-4000 C.F.M.
 ARRANGEMENT 2 RECESS REDUCES PROJECTION INTO ROOM. SAME TYPE AS ARR. 1 CAPACITIES 600-4000 C.F.M.	 ARRANGEMENT 6 SIMILAR TO ARR. 5 EXCEPT INLET RAISED ABOVE BOTTOM OF CABINET CAPACITIES 600-1500 C.F.M.
 ARRANGEMENT 3 SIMILAR TO ARR. 1 EXCEPT INLET RAISED AS IS NECESSARY WITH CERTAIN KIND OF BUILDING CONSTRUCTION. CABINET 4" DEEPER THAN ARR. 1 CAPACITIES 600-1500 C.F.M.	 ARRANGEMENT 7 UNIT SUPPORTED FROM CEILING AIR DISCHARGE HORIZONTAL CAPACITIES 600-4000 C.F.M.
 ARRANGEMENT 3-A SAME AS ARR. 3 EXCEPT RECESS REDUCES PROJECTION INTO ROOM CAPACITIES 600-1500 C.F.M.	 ARRANGEMENT 8 UNIT LAID WITH BACK ON FLOOR AIR DISCHARGE HORIZONTAL CAPACITIES 600-4000 C.F.M.
 ARRANGEMENT 4 FRESH AIR INLET THROUGH WINDOW OPENING. USED WHERE WALL INLETS ARE OBJECTIONABLE CAPACITIES 600-1500 C.F.M.	 ARRANGEMENT 9 MADE IN CAPACITIES 2000-4000 C.F.M. ONLY. FOR USE WHERE INLET DAMPERS ARE NOT PART OF UNIT



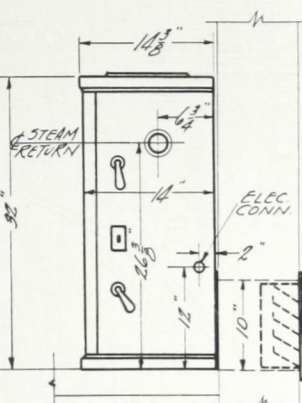
PLAN VIEW ARR. #1.



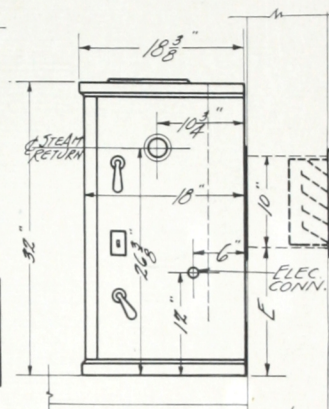
PLAN VIEW ARR. #3



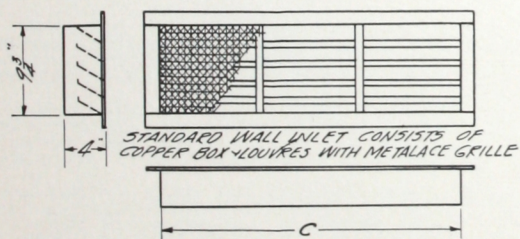
FRONT VIEW ARR. #1



SIDE VIEW ARR. #1.



SIDE VIEW ARR. #3



DETAIL OF WALL INLET FOR ARR. #1 & #3

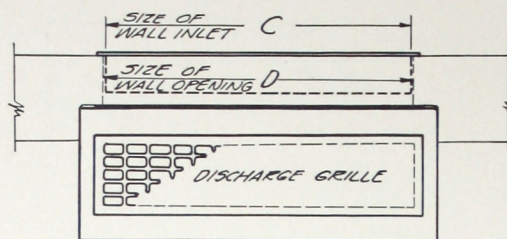
NOTES

1. ON ARR. #1 BOTTOM OF INLET SHOULD BE LEVEL WITH BOTTOM OF CABINET AND IN NO CASE MORE THAN $\frac{1}{2}"$ ABOVE OR 2" BELOW AS CLOSE AS RUN OF BRICK WILL PERMIT.
2. HAND OF STEAM & RETURN CONNECTIONS ARE REVERSIBLE BOTH $1\frac{1}{2}"$. CONTRACTOR TO PROVIDE SHORT NIPPLE AND $1\frac{1}{2}" \times 3/4"$ REDUCING ELBOW FOR STEAM RETURN.
3. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE ON LEFT SIDE 18" FROM BOTTOM OF CABINET.
4. $\frac{3}{8}"$ THICK SOFT WOOL FELT GASKET IS FURNISHED IN BACK OF CABINET AROUND INLET OPENING.

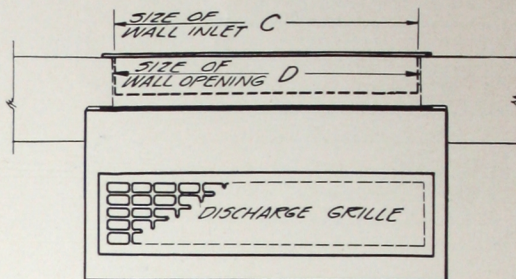
TABLE

SIZE	A	B	C	D	E
550					DETERMINED BY BUILDING CONSTRUCTION NOT OVER 20"
600					
750	$40\frac{1}{4}"$	41	$33\frac{3}{4}"$	34	
900					
1050					
1200					
1350					
1500	$50\frac{1}{4}"$	51	$41\frac{3}{4}"$	42	
1750					

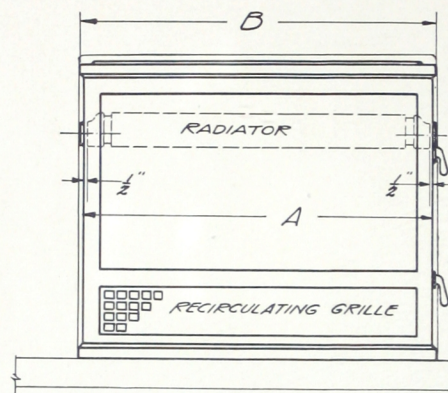
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UNIT VENTILATOR
MODEL 31



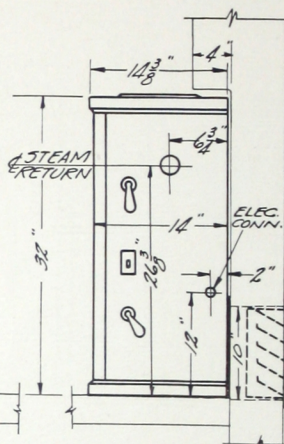
PLAN VIEW ARR. #2



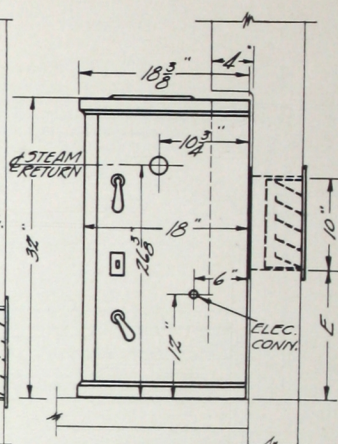
PLAN VIEW ARR. #3A



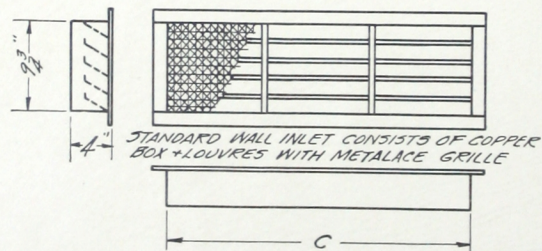
FRONT VIEW ARR. #2



SIDE VIEW ARR. #2



SIDE VIEW ARR. #3A



DETAIL OF WALL INLET FOR ARR. #2+3A

TABLE

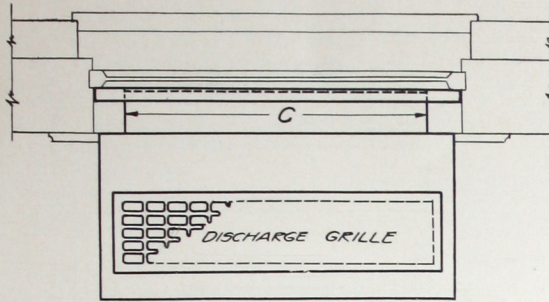
SIZE	A	B	C	D	E
430					
600	40 1/4	41	33 3/4	34	
750					
900					
1050					
1200					
1350	50 1/4	51	41 3/4	42	
1500					
1750					

DETERMINED
BY BUILDING
CONSTRUCTORS
NOT OVER 20"

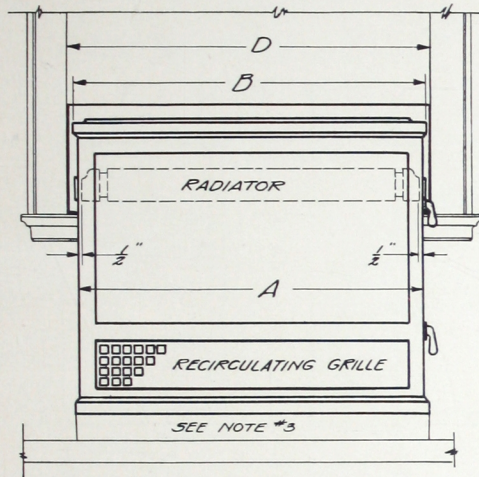
NOTES

1. ON ARR. #2 BOTTOM OF INLET SHOULD BE LEVEL WITH BOTTOM OF CABINET AND IN NO CASE MORE THAN 1/2" ABOVE OR 2" BELOW AS CLOSE AS RUN OF BRICK WILL PERMIT.
2. HAND OF STEAM & RETURN CONNECTIONS ARE REVERSIBLE BOTH 1/2". CONTRACTOR TO PROVIDE SHORT NIPPLE AND 1/2" x 3/4" REDUCING ELBOW FOR STEAM RETURN.
3. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE ON LEFT SIDE 18" FROM BOTTOM OF CABINET.
4. 3/8" THICK SOFT WOOL FELT GASKET IS FURNISHED IN BACK OF CABINET AROUND INLET OPENING.
5. RECESS MAY BE GREATER THAN 4" IN DEPTH IF PROVISIONS ARE MADE TO ACCOMMODATE STEAM PIPING AND TO PERMIT FLOW OF AIR AT DISCHARGE.

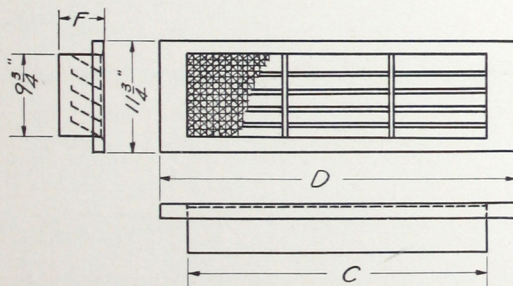
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PLAN VIEW ARR. #4

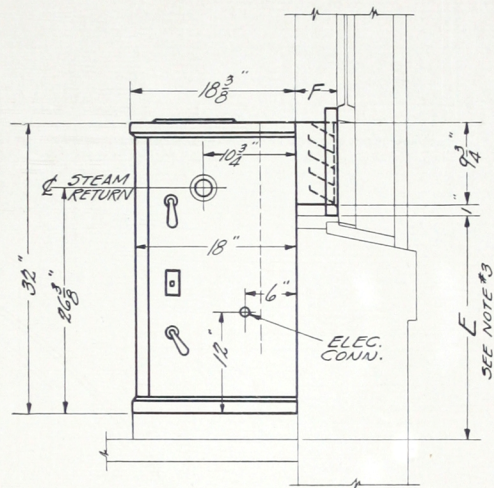


FRONT VIEW ARR. #4

DETAIL OF WINDOW INLET FOR ARR. #4
SEE NOTE #4

TABLE

SIZE	A	B	C	D	E	F
450				SEE NOTE #3		
600						
750	40 $\frac{1}{4}$	41	33 $\frac{3}{4}$			
900						
1050						
1200						
1350	50 $\frac{1}{4}$	51	41 $\frac{3}{4}$			
1500						
1750						

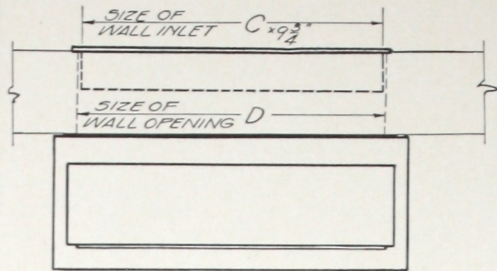


SIDE VIEW ARR. #4

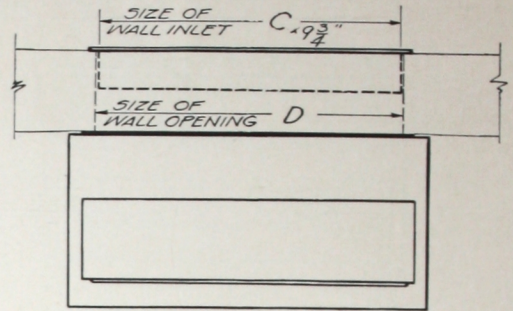
NOTES

1. HAND OF STEAM & RETURN CONNECTIONS ARE REVERSIBLE BOTH 1/2" CONTRACTOR TO PROVIDE SHORT NIPPLE AND 1/2" x 3/4" REDUCING ELBOW FOR STEAM RETURN
2. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE ON LEFT SIDE 18" FROM BOTTOM OF CABINET.
3. BASE IS REQUIRED TO RAISE HEIGHT OF CABINET WHEN "E" EXCEEDS 21". STEEL BASE FINISHED TO MATCH CABINET WILL BE FURNISHED WHEN SPECIFIED.
4. WINDOW INLET CONSISTS OF FURNITURE STEEL BOX, COPPER LOUVRES, BRONZE METALACE GRILLE AND WOOD FRAME. BOX AND FRAME ARE FINISHED TO MATCH CABINET.
5. CABINET BACK AND WINDOW INLET ARE BUILT TO ORDER TO SUIT DIMENSIONS D-E-F.

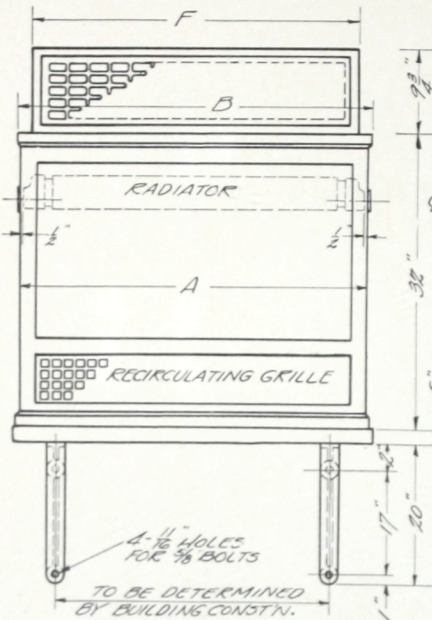
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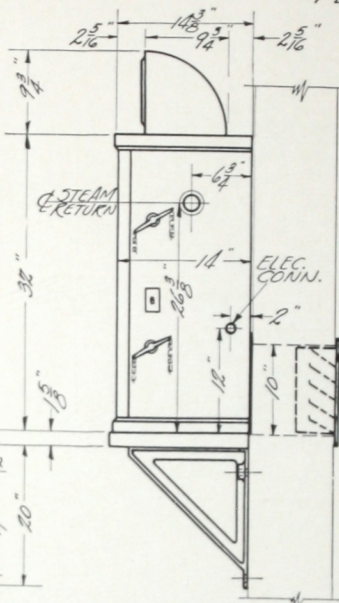
PLAN VIEW ARR. #5



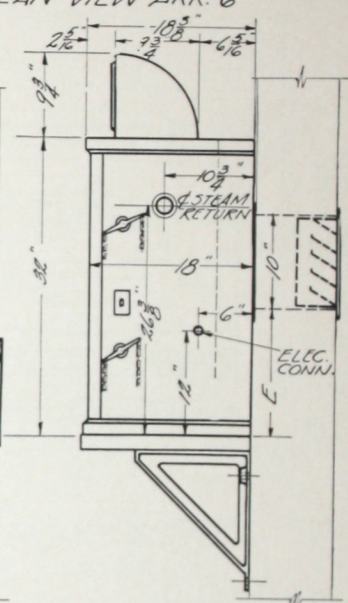
PLAN VIEW ARR. #6



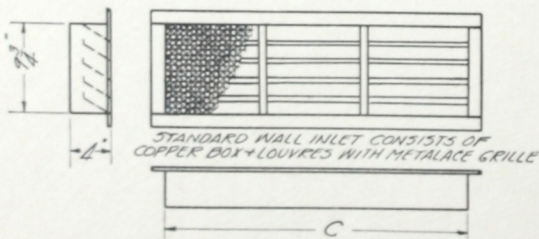
FRONT VIEW ARR. #5



SIDE VIEW ARR. #5



SIDE VIEW ARR. #6



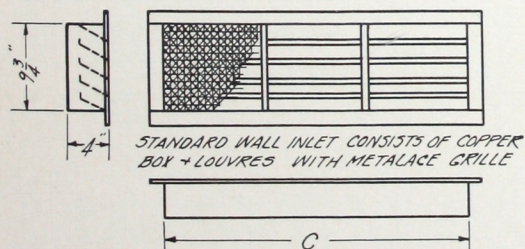
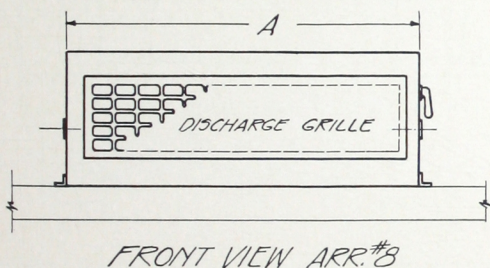
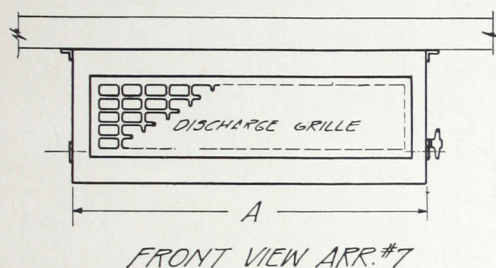
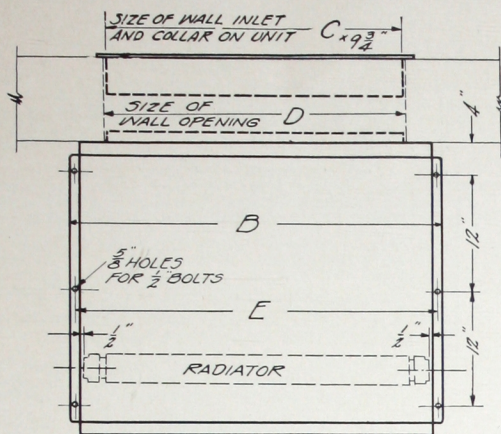
DETAIL OF WALL INLET FOR ARR. #5

SIZE	A	B	C	D	E	F
430						
450						
500						
550						
600	40 $\frac{1}{2}$	41	33 $\frac{3}{4}$	34		40
650						
700						
750						
800						
850						
900						
950						
1000						
1050						
1100						
1150						
1200						
1250						
1300						
1350						
1400						
1450						
1500						
1550						
1600						
1650						
1700						

NOTES

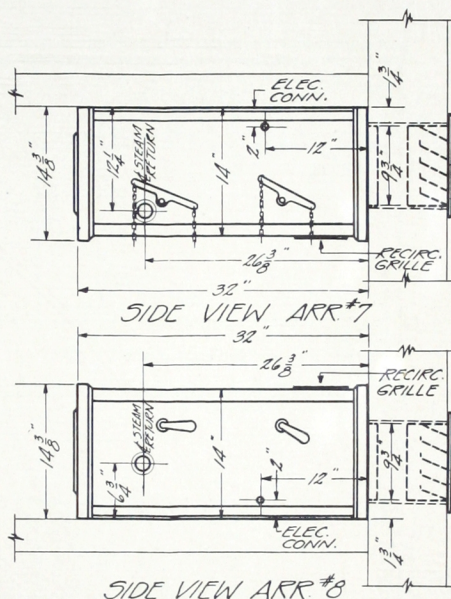
1. ON ARR. #5 BOTTOM OF INLET SHOULD BE LEVEL WITH BOTTOM OF CABINET AND IN NO CASE MORE THAN $\frac{1}{8}"$ ABOVE OR $2"$ BELOW AS CLOSE AS RUN OF BRICK WILL PERMIT.
2. HAND OF STEAM & RETURN CONNECTIONS ARE REVERSIBLE BOTH $\frac{1}{2}"$ CONNECTOR TO PROVIDE SHORT NIPPLE AND $1\frac{1}{2}" \times \frac{3}{8}"$ REDUCING ELBOW FOR STEAM RETURN.
3. HAND DAMPER CHAIN CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE ON LEFT SIDE $18"$ FROM BOTTOM OF CABINET.
4. $\frac{3}{8}"$ THICK 30 FT WOOL FELT GASKET IS FURNISHED IN BACK OF CABINET AROUND INLET OPENING.

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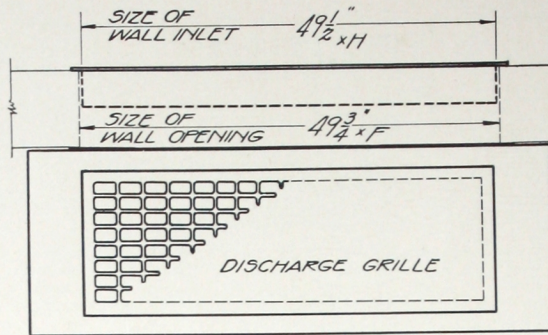
- NOTES

1. HAND OF STEAM * RETURN CONNECTIONS ARE REVERSIBLE BOTH 1/2" CONTRACTOR TO PROVIDE SHORT NIPPLE AND 1/2" & 3/4" REDUCING ELBOW FOR STEAM RETURN.
2. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS FOR AIR #7 ARE ON LEFT SIDE 18" FROM REAR OF CABINET AND 2" FROM TOP. CONNECTIONS FOR PNEUMATIC CONTROLS FOR AIR #8 ARE ON RIGHT SIDE 18" FROM REAR OF CABINET AND 2" FROM BOTTOM.
3. STARTING SWITCH IS FURNISHED UNATTACHED TO UNIT CABINET.
4. COLLAR FOR DUCT CONNECTION MAY BE FURNISHED IN PLACE OF DISCHARGE OUTLET GRILLE.

TABLE

SIZE	A	B	C	D	E
430					
460					
520	$40\frac{1}{4}$	$44\frac{1}{4}$	$33\frac{3}{4}$	34	$42\frac{1}{2}$
900					
1050					
1200					
1350					
1500	$50\frac{1}{4}$	$54\frac{1}{4}$	$41\frac{3}{4}$	42	$52\frac{1}{2}$
1750					

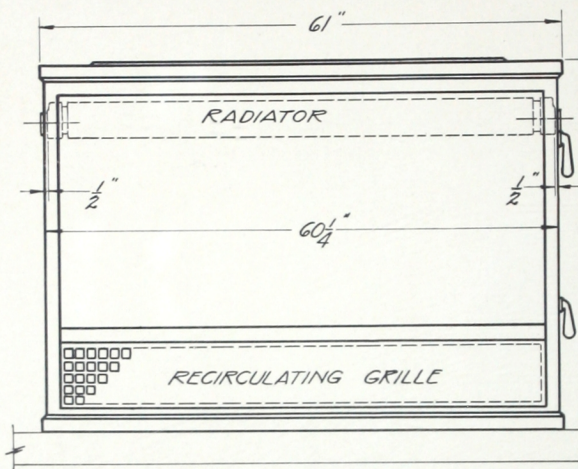
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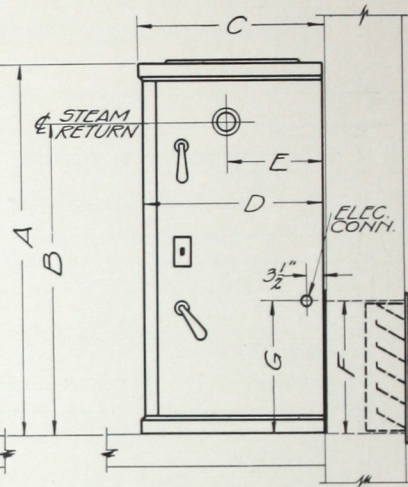
PLAN VIEW ARR.#1

NOTES

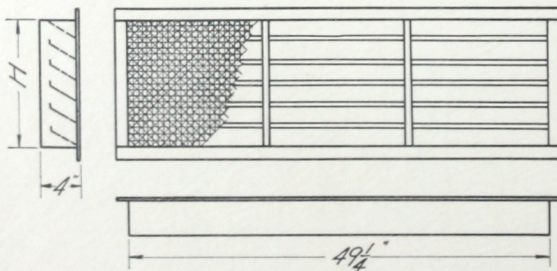
1. BOTTOM OF INLET SHOULD BE LEVEL WITH BOTTOM OF CABINET AND IN NO CASE MORE THAN $\frac{1}{2}$ " ABOVE OR 2" BELOW AS CLOSE AS RUN OF BRICK WILL PERMIT
2. HAND OF STEAM+RETURN CONNECTIONS ARE REVERSIBLE BOTH 2" CONTRACTOR TO PROVIDE SHORT NIPPLE + 2"x1" REDUCING ELBOW FOR STEAM RETURN.
3. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE ON LEFT SIDE 27" FROM BOTTOM OF CABINET FOR SIZES 2000 TO 3500 AND 33" FROM BOTTOM OF CABINET FOR SIZE 4000.
4. $\frac{3}{8}$ " THICK SOFT WOOL FELT GASKET 15" FURNISHED IN BACK OF CABINET AROUND INLET OPENING.



FRONT VIEW ARR.#1



SIDE VIEW ARR.#1



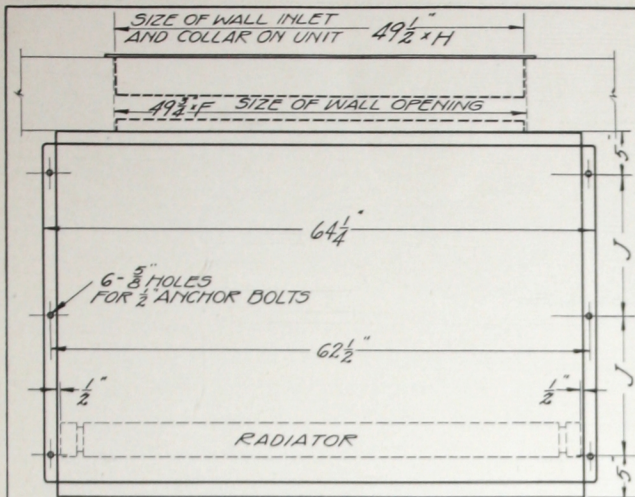
DETAIL OF WALL INLET

STANDARD WALL INLET CONSISTS OF COPPER BOX AND LOUVRES WITH METALACE GRILLE

TABLE

SIZE	A	B	C	D	E	F	G	H
2000 TO 3500 INCL.	42	35 $\frac{1}{4}$	20 $\frac{1}{2}$	19 $\frac{3}{4}$	10 $\frac{1}{8}$	15 $\frac{3}{4}$	24	15 $\frac{1}{2}$
4000	52	44 $\frac{3}{4}$	25 $\frac{1}{2}$	24 $\frac{3}{4}$	9 $\frac{5}{8}$	26 $\frac{1}{2}$	30	26

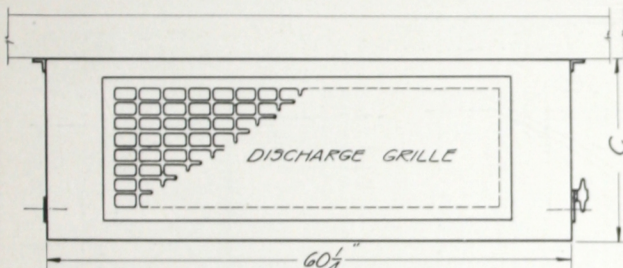
STURTEVANT
UNIT VENTILATOR
MODEL 31



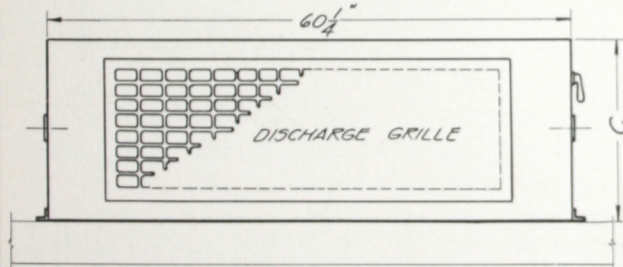
PLAN VIEW ARR. #7 & 8

NOTES

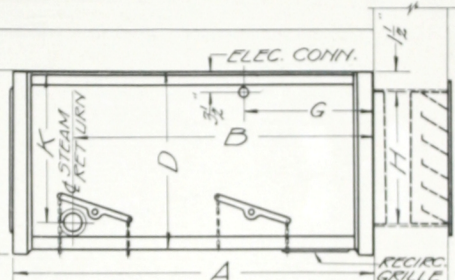
1. HAND OF STEAM+RETURN CONNECTIONS ARE REVERSIBLE BOTH 2" CONTRACTORS TO PROVIDE SHORT HIPPLE AND 2"x1" REDUCING ELBOW FOR STEAM RETURN.
2. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. CONNECTIONS FOR PNEUMATIC CONTROLS ARE LOCATED 27" FROM REAR OF CABINET FOR SIZES 2000 TO 3500 AND 33" FROM REAR OF CABINET FOR SIZE 4000. CONNECTIONS ARE ON LEFT SIDE $3\frac{1}{2}$ " FROM TOP FOR ARR. #7 AND ON RIGHT SIDE $3\frac{1}{2}$ " FROM BOTTOM FOR ARR. #8.
3. STARTING SWITCH IS FURNISHED UN-ATTACHED TO UNIT CABINET
4. COLLAR FOR DUCT CONNECTION MAY BE FURNISHED IN PLACE OF DISCHARGE GRILLE



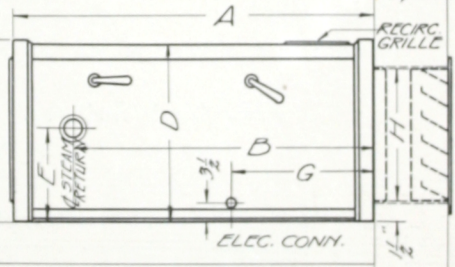
FRONT VIEW ARR. #7



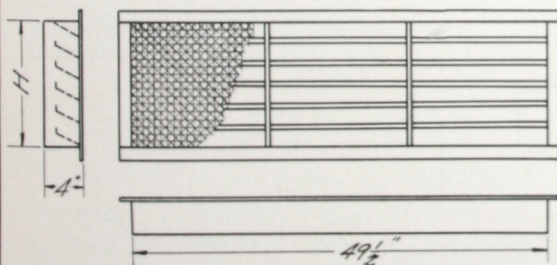
FRONT VIEW ARR. #8



SIDE VIEW ARR. #7



SIDE VIEW ARR. #8



DETAIL OF WALL INLET

STANDARD WALL INLET CONSISTS OF COPPER BOX AND LOUVRES WITH METALACE GRILLE

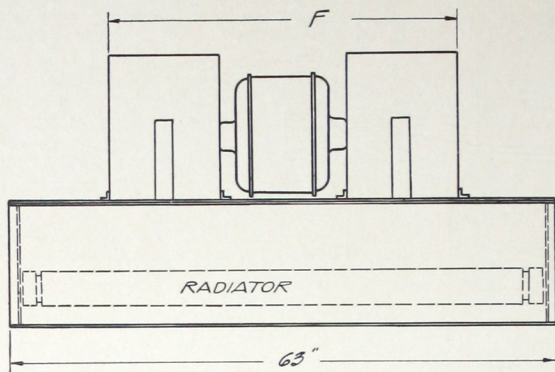
TABLE

SIZE	A	B	C	D	E	F	G	H	J	K
2000 TO 3500 INCL	42	$35\frac{1}{2}$	$20\frac{1}{4}$	$19\frac{3}{4}$	$10\frac{5}{8}$	$15\frac{1}{2}$	24	$15\frac{1}{2}$	16	$17\frac{1}{2}$
4000	52	$44\frac{3}{4}$	$25\frac{1}{2}$	$24\frac{3}{4}$	$9\frac{5}{8}$	21	30	$20\frac{3}{4}$	21	$22\frac{1}{2}$

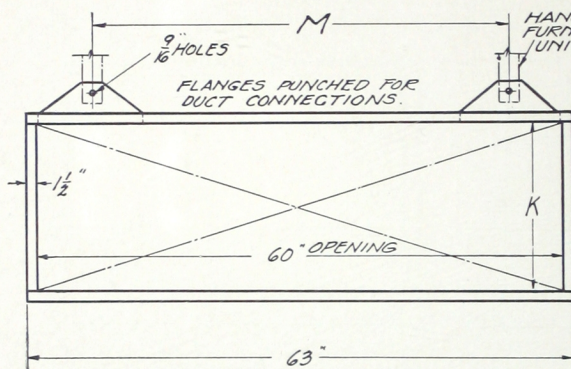
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NOTES

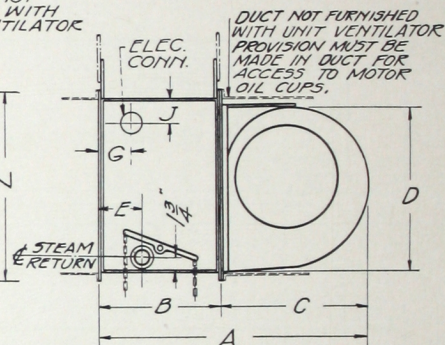
1. HAND OF STEAM + RETURN CONNECTIONS ARE REVERSIBLE BOTH 2" CONTRACTOR TO PROVIDE SHORT NIPPLE + 2"x1" REDUCING ELBOW FOR STEAM RETURN.
2. HAND DAMPER CONTROLS AS SHOWN ARE OMITTED WHEN PNEUMATIC CONTROLS ARE REQUIRED. PNEUMATIC CONTROL CONTRACTOR WILL MOUNT MOTORS ON UNITS AT JOB.



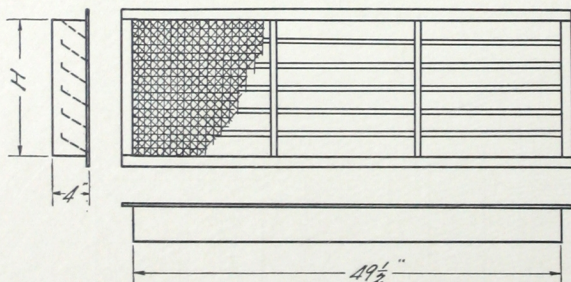
PLAN VIEW ARR.#9



FRONT VIEW ARR.#9



SIDE VIEW ARR.#9



DETAIL OF WALL INLET

STANDARD WALL INLET CONSISTS OF COPPER BOX AND LOUVRES WITH METAL GRILLE

SIZE	A	B	C	D	E	F	G	H	J	K	L	M
2000 TO 3500 INCL.	30 1/2	14	16 1/2	18 1/2	4 3/4	4 1/4	3 1/2	15 1/2	2	19	22	55 1/2
4000	44 1/2	24	20 1/2	23	10 1/4	4 1/4	10	26	5	26	29	54

STURTEVANT
UNIT VENTILATOR
MODEL 31.

Specifications for Sturtevant Unit Ventilators

THE following is offered to architects and engineers as a guide for the preparation of specifications covering the installation of unit ventilators. The information outlined is essential for obtaining the best material, for ordering the apparatus, and for accurate estimate of price by both contractor and manufacturer. It is not intended to describe the apparatus in detail. The items may be expanded by the specification writer if he so desires.

General

Furnish and install Sturtevant Unit Ventilators as shown on the accompanying plans and listed in the following table. Refer also to catalog No. 377 of the B. F. Sturtevant Company, Hyde Park, Boston, Mass. (Sturtevant Wisconsin; Berkeley, Cal.; Camden, N. J.; Galt, Ontario).

Unit Ventilator Cabinets

Unit cabinets shall be constructed of full-finished stretcher-leveled furniture steel of not lighter than 16 gauge, and reinforced by channel construction. The fronts of cabinets shall lock in place, and one key shall fit all locks. Five keys shall be furnished with installation.

Cabinets shall be finished with two coats of olive-green enamel baked on and rubbed to a dull finish.

Motors

Electric motors shall be Sturtevant "Super-silent" as made by the B. F. Sturtevant Company, particularly for unit ventilators. (Motors shall be designed to

operate on three phase cycle volt alternating current) or (motors shall be designed to operate on single phase, cycle, volt alternating current. They shall be of the condenser type without commutators, brushes, or automatic cut-outs, of any kind) or (motors shall be designed to operate on volt direct current.) Speed regulators shall be furnished.

Motor bearings shall be phosphor-bronze, sleeve-type, wool-packed, and shall have an oil reservoir large enough to contain oil supply for not less than six months.

Temperature Dampers

The temperature of the air discharged by the unit ventilator shall be controlled by dampers placed between fan outlets and heating surface so that any portion, or all, of the air may be bypassed unheated. The warmed air and the bypassed air shall be mixed at the outlet of the unit. The dampers must be gradual acting, properly balanced, and supported in bearings of non-corrosive material.

They shall be operated (by the Sturtevant Automatic Self-Contained Temperature Regulator) or (by a pneumatic system of temperature regulation as mentioned elsewhere in these specifications) or (by hand control levers).

Inlet Dampers

All Unit Ventilators shall be provided with (inlet and recirculating dampers) or (inlet dampers) for closing inlet opening when units are not operating or when it is desired to recirculate entirely room air.

ROOM NO.	SIZE C. F. M.	ARRANGEMENT NO.	TYPE
			Recirculating Non Recirculating Partially Recirculating
(here insert a schedule of Units)			

They shall be operated (by hand control levers) or (by remote control devices called for under the part of this specification referring to pneumatic system of automatic temperature regulation).

Heating Surface

The heating surface shall be a light weight fin tube type as made specially for Sturtevant Unit Ventilators and will operate with steam at pressures between 0 and 10 pounds per square inch.

It shall be suitable for pressures up to 35 pounds per square inch and also at pressures below atmospheric.

Partial Recirculation Feature (optional)

The unit ventilators shall be arranged so that fifty per cent of the volume of air delivered may be recirculated while fifty per cent is supplied from out-of-doors. They shall also be arranged so that all the air may be supplied from out-of-doors, or all recirculated at the discretion of the operator by changing a simple damper mechanism. Both out-of-door and recirculated air must pass through the unit ventilator in such a manner that any part or all of it may be heated to proper temperature, and the air travel must be so arranged that out-of-door air cannot blow through the recirculating opening.

Air Filters

Furnish Air Filters within the unit ventilator cabinets of the adhesive type. Also furnish one cleaning tank, one charging

tank, one extra filter cell for each size of unit specified and gallons of charging fluid, all as regularly furnished by the B. F. Sturtevant Company. (Air filters may be omitted.)

Fresh-Air Inlets

Furnish fresh-air inlets for all units as made up by B. F. Sturtevant Company. (Omit fresh-air inlets if units are to be used for recirculation only.) (Inlets shall be of wall type and shall consist of 18-ounce copper frames and louvers, double hemmed on all edges, and shall be provided with "Metalace" bronze grilles. Sizes shall be as specified by unit ventilator manufacturer. Heating contractor shall be responsible for the proper location and size of inlets. Masonry contractor will set inlets in place.

If arrangement 4 unit ventilators are required: (Inlets shall be of window type for arrangement 4 unit ventilators, and shall consist of furniture steel frames of 16 gauge finished to match cabinets. They shall be provided with 18-ounce copper louvers, double hemmed on all edges and copper wire screens of $\frac{3}{8}$ " square mesh. The heating contractor shall check all necessary measurements at the building after window sashes are in place and floors are finished, to make certain that inlets will come of proper size to suit the conditions. The general contractor shall furnish frames for inlets to match adjacent woodwork in accordance with the heating contractor's instructions.

Electrical Connections

An electric switch shall be mounted on every unit ventilator cabinet and shall be furnished by the unit manufacturer, together with all necessary wiring to motors.

The electrical contractor will install outlets as directed by heating contractor and will provide all service connections, conduit, and wiring necessary for proper operation of the system, and will make connections to units after same are set in place.

Delivery

Unit ventilators shall not be delivered to the building before plastering is complete and floors are finished. The heating contractor will be responsible for any damage to units before acceptance, and any repairs necessary shall be made at his expense.

Guarantee

Units shall be guaranteed to deliver their full rating both in volume of air and temperature rise. Air volumes shall be measured by means of a calibrated anemometer in accordance with recommendations of A. S. H. V. E. Temperatures shall be taken at the inlet openings and at the outlet grilles by means of calibrated thermometers.

The radiators shall be guaranteed for steam working pressures up to 35 pounds gauge. They shall be tested to 75 pounds steam pressure at the factory.

Any parts proving defective within one year of final acceptance shall be replaced at manufacturer's expense.

Insert in Masonry Specifications

The masonry contractor shall leave openings in walls for fresh-air inlets for unit ventilators as directed by the heating contractor, and shall set inlets furnished by heating contractor in openings and mortar them in place in a neat and careful manner. Approximate sizes and locations are shown on plans, but exact dimensions shall be obtained from the heating contractor before masonry is started.

Insert in Electrical Specifications

The electrical contractor shall furnish an outlet for every unit ventilator furnished under the heating contract. He shall also make service connections and provide all wiring, conduit, and other materials necessary for the satisfactory operation of the unit motors and in strict accordance with all laws and regulations pertaining to this work which have jurisdiction.

Electric current for unit motors shall be phase cycle (or direct) volt.

Electrical contractor shall make connections between outlets and unit ventilators, by means of armored cable after units are set in place. Outlets shall be located as directed by heating contractor.

Electrical contractor shall also provide distributing panels with fused switch for each circuit. Not more than three units shall be connected to one circuit.

A Few of the Many Sturtevant

<i>Name</i>	<i>Location</i>	<i>No. Units</i>
City Bank and Farmers Trust Company Bldg.....	New York City	90
Grant Central Telephone Exchange	Pittsburgh, Pa.....	138
Worcester Telephone Exchange	Worcester, Mass.....	85
Boston and Maine R. R. Industrial Bldg.....	Boston, Mass.....	32
Herald-Traveler Building	Boston, Mass.....	20
Packard Motor Car Co.	Boston, Mass.....	5
Yale University.....	New Haven, Ct.....	52
Harvard University	Cambridge, Mass.....	18
Johns Hopkins University	Baltimore, Md.....	11
University of California.....	Berkeley, Calif.	36
University of Cincinnati	Cincinnati, Ohio.....	30
Western Electric Co.	Kearny, N. J.	21
Ticonderoga, New York, High School	Ticonderoga, N. Y.....	37
Scotia, New York, Junior High School.....	Scotia, N. Y.....	24
Park Street School.....	Long Beach, L. I.....	47
Lincoln Belmont Y. M. C. A.....	Chicago, Ill.....	27
Pollard School.....	Ashland, Ky.....	15
Baltimore "Sun" Bldg.....	Baltimore, Md.....	7
Somerville High School.....	Somerville, Mass.....	72
Odd Fellows Temple	Springfield, Mass.....	14
Ford Junior High School.....	Youngstown, Ohio.....	41
Wilson Junior High School.....	Youngstown, Ohio.....	35
Walnut Hills High School.....	Cincinnati, Ohio.....	25
Continuation School.....	Reading, Pa.....	27
Connelly Trade School	Pittsburgh, Pa.....	57

Unit Ventilator Installations

<i>Name</i>	<i>Location</i>	<i>No. Units</i>
Manheim Township School.....	Neffsville, Pa.....	34
Junior and Senior High School.....	Quakertown, Pa.....	24
Wyoming Seminary.....	Kingston, Pa.....	30
Uinta School.....	Salt Lake City, Utah.....	18
Clinton Kelly High School of Commerce.....	Portland, Ore.....	72
Grout School.....	Portland, Ore.....	29
Portsmouth School.....	Portland, Ore.....	25
Llewellyn School.....	Portland, Ore.....	22
Arleta School.....	Portland, Ore.....	23
Beech School.....	Portland, Ore.....	19
Duniway School.....	Portland, Ore.....	17
Jefferson High School.....	Portland, Ore.....	12
Linton School.....	Portland, Ore.....	17
Vestal School.....	Portland, Ore.....	30
Quincy Point Junior High School.....	Quincy, Mass.....	25
North Junior High School.....	Quincy, Mass.....	25
Adams Shore School.....	Quincy, Mass.....	13
Merrymount School.....	Quincy, Mass.....	13
Montclair School.....	Quincy, Mass.....	11
Saunders Trade School.....	Yonkers, N. Y.....	30
Public School 24.....	Yonkers, N. Y.....	20
Public School 25.....	Yonkers, N. Y.....	6
Public School 41.....	Rochester, N. Y.....	24
Public School 42.....	Rochester, N. Y.....	26

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